The perceptions of dental hygiene students about an asynchronous oral biology course

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PRACTICAL IMPLICATIONS OF THIS RESEARCH

- Online learning has become an integral part of dental hygiene education due to the COVID-19 pandemic.
- To increase student engagement and improve the quality of teaching and assessments in online classes, innovations are needed.
- The identification of key factors affecting the online learning experience of dental hygiene students will help to guide the design of more effective online courses for dental hygiene and other health science education.

ABSTRACT

Background: Medical and dental schools have long-established pedagogical approaches to teacher-centred face-to-face learning. The 3-year baccalaureate dental hygiene (DH) program at the University of Alberta, which enrolls 42 students of diverse ages and experiences each year, is no exception. Oral Biology II (OBIOL 302) is an intermediate-level course in the DH program; it was moved to an asynchronous online format to manage the disruptions of the COVID-19 pandemic. This mixed-method study explores the factors affecting the dental hygiene student experience in this online, asynchronous learning environment. **Methods:** This study used a quantitative anonymous survey with a 5-point Likert scale to evaluate the workload and flexibility of the course as well as student acceptance of the assessments. The mean score and standard deviation were calculated for each question in the online survey. A research facilitator conducted interviews using a semi-structured interview guide to further explore student experiences. The qualitative data were then analyzed using a 6-step method of thematic analysis. **Results:** The study participants found the format and workload of the online course appropriate and well-suited to the spring term. Thematic analysis of the qualitative data revealed 3 intersecting elements—course structure, communication, and non-curricular aspects—as the key factors shaping student experiences in an online environment. **Conclusion:** This study identified the major factors affecting the online learning experience of students from the students' point of view, which will be a useful guide to design more effective online courses for health science education.

RÉSUMÉ

Contexte : Les écoles de médecine et de dentisterie ont depuis longtemps établi des approches pédagogiques en personne centrées sur l'enseignant. Le programme de baccalauréat de 3 ans en hygiène dentaire (HD) de l'Université de l'Alberta, qui accueille chaque année 42 étudiants de divers âges et expériences, ne fait pas exception. En vue de gérer les perturbations de la pandémie de la COVID-19, *Oral Biology II* (OBIOL 302), un cours de niveau intermédiaire au programme d'hygiène dentaire, a été déplacé vers un format asynchrone et en ligne. La présente étude à méthode mixte explore les facteurs qui influencent l'expérience des étudiants en hygiène dentaire dans un environnement d'apprentissage asynchrone et en ligne. **Méthodologie :** Cette étude a utilisé une enquête quantitative anonyme et une échelle de Likert en 5 points pour évaluer la charge de travail et la flexibilité du cours, ainsi que la manière dont les étudiants ont accueilli les évaluations. La cote moyenne et l'écart type ont été calculés pour chaque question de l'enquête menée en ligne. Un facilitateur de recherche a mené des entretiens à l'aide d'un guide d'entretien semi-structuré en vue d'explorer davantage les expériences des étudiants. Une analyse des données qualitatives a ensuite été réalisée à l'aide d'une méthode d'analyse thématique en 6 étapes. **Résultats :** Les participants à l'étude ont trouvé le format et la charge de travail du cours en ligne appropriés et bien adaptés au semestre du printemps. L'analyse thématique des données qualitatives a révélé 3 éléments interdépendants comme étant les facteurs clés qui façonnent les expériences des étudiants dans un environnement en ligne : la structure du cours, la communication et les aspects non scolaires. **Conclusion :** Cette étude a défini les principaux facteurs ayant une incidence sur l'expérience d'apprentissage en ligne des étudiants, selon le point de vue de ces derniers, ce qui constituera un guide utile pour élaborer des cours en ligne plus efficaces pour l'enseignement des sciences de la santé.

Keywords: communication; education; education, dental; education, distance; learning; perception
CDHA Research Agenda category: capacity building of the profession

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INTRODUCTION

Though the educational realm has been increasingly using technology as a tool for teaching and learning, the COVID-19 pandemic abruptly accelerated this process. This shift significantly impacted both instructors and students, many of whom had little to no experience with teaching or learning in an online delivery format. While significant work has already been done to explore the success and performance of students in the online environment,[1,2] less is known about the actual student experience of participating in an online class.

Several frameworks have been proposed for understanding the critical components that can affect the student experience in online education, such as technology, pedagogy, creativity, and interactivity. However, much of this work focuses on workplace-based learning, adult learners or very young learners.[3–5] Undergraduate students are a unique population of learners with distinct cognitive, emotional, and social traits. Though they are legally considered adults, they are still developing and emerging as adult learners, displaying varying ratios of pedagogical and andragogical learner characteristics.[6,7] Teaching health professional students poses additional challenges as their age and life experiences can be diverse.

The dental hygiene (DH) program at the University of Alberta offers a 3-year baccalaureate degree, where the entering students are diverse in age, experience, and educational background. Some students enter the program immediately following their preprofessional year, while others have graduate-level education and multiple years of work experience. Teaching such a heterogeneous class is a challenge that is amplified in the online environment.

Oral Biology II (OBIOL 302) is an intermediate-level course in the dental hygiene program covering foundational science topics. Though usually an in-person course, OBIOL 302 was delivered in an asynchronous, online format over 6 weeks in the spring 2020 semester due to COVID-19 pandemic restrictions on in-person teaching. It was structured with 5 weekly quizzes, 2 written assignments, and a recorded voice-over presentation where students were required to research and draw logical conclusions from the scientific literature on a topic of their choice.

An explanatory mixed-method study was conducted using a quantitative survey to evaluate the course load, flexibility, student acceptance of the online course, and alternative assessments, followed by semi-structured interviews to collect qualitative data to further explain the findings from initial quantitative survey results.[8] The survey aimed to answer the following questions:

1. What are student perspectives on the flexibility and workload of the online course?
2. What is mostly "missed" in an online environment compared to face-to-face delivery?
3. How comfortable were the students with the alternative assessment methods?
4. What is the overall satisfaction rate of online learning?

The qualitative portion focused on further investigating student learning experiences and factors affecting their learning in a diverse, online, and asynchronous environment. The general research questions for the qualitative research were as follows:

1. How do the dental hygiene students studying at the University of Alberta describe their experiences in a diverse, online, and asynchronous learning environment?
2. What features of face-to-face learning were significantly missed in an online environment from students' perspectives?
3. In students' opinion, what factors motivate students in online learning?

METHODS

Ethics approval

This study was reviewed and approved by the University of Alberta Research Ethics Board (REB 2) (Ethics ID# Pro00101540, Renewed as Pro00101540_REN1).

Study design and participants

It was an explanatory mixed-method study, where qualitative interview data were collected to further explain the findings from initial quantitative survey results.[8] The study participants were third-year students in the DH program at the University of Alberta, who had taken the online Oral Biology II (OBIOL 302) course in spring 2020. This 3-year baccalaureate program enrolls 42 students yearly. Usually, for a typical dental hygiene class, student ages range from 19 years to 34 years, and the mean age is 22 years.

Instrument

The research questions guided the survey development. The survey was designed to gather a general picture of course load, time flexibility, motivation, and overall satisfaction. The online anonymous survey was conducted using the survey tool REDCap.[9,10] The survey had 11 questions that were scored on a 5-point Likert scale (1 indicating strong disagreement and 5 indicating strong agreement with the corresponding statement).

Based on the survey results, the semi-structured interview guide was developed to further investigate student experiences and factors affecting their learning. The interview was conducted by an experienced interviewer who was not involved with the study and was not an instructor of the students.

Procedure

After completing the OBIOL 302 course in the 2020 spring semester, all 42 students in the class were invited via email to take an online survey regarding their experience in

the online course. Because the researchers (NS and AKC) hold faculty positions in the School of Dentistry, they had a power relationship with students that could have compromised the students' freedom to decline. To ensure this did not happen, the research facilitator within the department, who is not a faculty member, sent the email invitations and recruited the participants. There were no exclusion criteria for the participants. At the end of the survey, students were asked if they could be interviewed to elucidate further details about their experiences.

The individual interviews were done over the Zoom Video Conferencing platform[11]; audio was recorded with a hand-held recorder. The interviews were semi-structured with questions that encouraged the students to reflect on the factors that may have shaped their experience of the course. Once the interview data were transcribed, all student identifiers were removed by the facilitator before the data were handed over to the authors for analysis.

Data analysis

Descriptive statistics, which included mean and standard deviations, were compiled to summarize the quantitative results from the survey. For the qualitative data analysis, the interview transcripts were imported into QDA Miner Lite (Provalis Research, Canada). Using Braun and Clarke's[12] 6-step method of thematic analysis, 2 reviewers independently examined and coded the data. Emergent categories were identified and condensed into broader thematic codes upon repeated analysis. Coding differences were discussed between the coders until both agreed that the identified themes and subthemes were reflective of the data obtained from the interviews.

RESULTS

Quantitative results

A total of 23 students (55% of the class) participated in the survey. The mean Likert score for each question is shown in Table 1. The survey was designed to evaluate the workload of the course, how well the course suited the students' schedule, and the acceptability of the assessments. Most of the participants found the workload of the online course appropriate, flexible, and nicely suited to their spring schedules. The average scores for the workload and flexibility-related questions were 4.3 (on a Likert scale of 5), with a standard deviation of 0.6 and 0.8 (Table 1). The majority of the participants positively accepted the assessments. The 3 questions exploring the students' acceptance of the assessment had an average score of 4.2, 3.5, and 4.3 (on a scale of 5) with low standard deviations. However, the questions aiming to compare online and face-to-face learning experiences had higher values of standard deviations, indicating variations in the students' opinions. These survey results led the researchers to conduct individual interviews to further explore student perceptions and experiences of learning in an online environment. No demographic data were collected for this study.

Qualitative results

The qualitative component of the study aimed to investigate the students' learning experiences and factors affecting their learning in a diverse, online, and asynchronous environment. Ten students participated in individual semi-structured interviews. Two interviews were excluded because those students had confused courses or mentioned instructors who did not teach in the OBIOL 302 online course. Elements that affected the student experience were extracted from the interview transcripts. Three main themes and their subthemes were identified:

1. Course structure
   - Format (online, asynchronous)
   - Assessments (spacing, weighting, type)
2. Communication
   - Timeliness
   - Clarity (expectations, learning objectives)
3. Non-curricular aspects
   - Executive functioning (time management, motivation, focus, organization)
   - Sense of community/connection (with peers, with instructors)

Course structure

Most students interviewed appreciated the asynchronous nature of the course as it allowed them the freedom and flexibility to study on their own terms. One participant indicated:

> *...you could do it totally on your own pace. If you really wanted to, you could watch all of them in one day. Or you could just watch it on the days that they were like released...if you really wanted to, you could speed them up like you would [view] on two times speed.*

Another participant appreciated the flexibility in accommodating their non-academic life.

> *It's flexible...with the asynchronous delivery, you can work those lectures and that course material around whatever else is happening in your life. If that means you're listening to a lecture at two o'clock in the morning, so be it, you have that flexibility.*

Another aspect of the course structure that affected the student experience related to the assessments. Students acknowledged that the timing, number, and types of assessments reduced acute stress because they did not involve writing a traditional midterm or final examination. The assignments also allowed for a deeper understanding of a specific topic. Student comments included:

Table 1. Students' response to online survey questions (n = 23)
Mean Likert scores for student survey: 1 = strongly disagree; 5 = strongly agree

Research question		Survey question	Average score	Standard deviation
Workload and flexibility	Q1	The workload of the online course was appropriate.	4.3	0.6
	Q2	The online course gives me more freedom and time flexibility compared to a face-to-face course.	4.3	0.8
Comparison between online and face-to-face learning (What is "missed" in online learning?)	Q3	I think I would understand the material better if it were presented in a face-to-face manner.	3.3	1.2
	Q4	I am confident that I have acquired the same knowledge as I would have in a face-to-face environment.	3.4	1.2
	Q5	I missed direct, in-person interaction with other students.	4.0	1.1
	Q6	I missed direct, in-person interaction with the instructors.	3.8	1.1
	Q7	The online delivery was a barrier to my overall learning.	2.5	0.9
Alternative assessment methods	Q8	The assessments of the online course were appropriate and fair.	4.2	0.7
	Q9	The alternative assignments (written assignments and student presentations) motivated me to study more on the subject matter.	3.5	1.3
	Q10	I enjoyed having alternative assignments (written assignments and student presentations) over final or midterm exams.	4.3	1.0
Overall satisfaction	Q11	Overall, my online learning experience was excellent.	3.7	0.9

I was way less stressed.

It's not as stressful either because you have time to make a project...as opposed to writing a test...

I just found it was like a little less stressful because you still test your learning but not in like it's mid-term or 30% or 40%. It allowed for just more increment learning I guess—not like a big final at the end or a big mid-term, but it was kind of on a weekly basis that you got tested on your knowledge.

It alleviated stress, and when I'm not as stressed I do better. And there's not as much like prep—there's less pressure I guess. So I also think it helps because there's less risk with those smaller assignments and quizzes. And so then you just feel more confident and calm going in, which is what helps me to do well.

In contrast, other students felt that the lack of a formal midterm or final exam hindered their understanding or retention of the material and performance in the course.

I think because I didn't have to really review it and really jam over it, there wasn't ever a moment where I had a lot of information sitting in my head...there wasn't a period where I would consider myself really adept with the course information.

If there was midterm final, I know I would have done better than everybody else in the class because kids in my class—a lot of them are kind of in it like "Cs get degrees," so they don't really care... if it came down to like a midterm or final, I know I would have studied and did really well.

Communication

The effectiveness of communication between the instructors and the class was another factor that impacted the students' online learning experience. Clearly outlined expectations and timeliness of communications were cited as necessary for a positive student experience.

I never was confused on which is tested on this quiz. Or like, what do I have to know? Or which-which day is it? It's very clear. I never once was confused or had to go back and look. It was just very, like, you do this and you do this, which I'm very a list person. So it was very good for me like to do this part and this part and it's just laid out. [The instructor] even had it tabbed by week, I think. So it's like this week is all of your stuff you do here.

> *And the next week is all this stuff. And there is no surprises like at the very beginning. She told us, you're going to have quizzes, and then you'll have these assignments. And so it wasn't like, "Oh, yeah, next week, you have an assignment" or whatever. She let us know right at the beginning what we had to do.*

> *I find that my class really likes knowing everything immediately out of the gates.*

Students remarked that reduced immediacy in communication in an online environment negatively affected their experiences.

> *I miss actually being able to—like if you have a question in class, you can just ask the prof like kind of right in the middle, so you can understand rather than they keep going, moving forward.*

Students also indicated that the logically organized site on the e-Class learning management system (LMS) positively impacted their online learning experiences.

> *It was very organized like [the course coordinator] came on, told us exactly what was expected of us. All the lectures were laid out perfectly on e-Class. So you're never confused, like, which one you had to do next, the schedule is perfectly laid out. So that's one of the first things I think I really appreciate about the course because sometimes classes can be super confusing if it's not organized on e-Class, especially if it's all online.*

> *I think [the course coordinator] organized it fairly intuitively. It was nice that she organized the lecture material according to week, to be able to easily identify where we were in the course and to be able to easily find the lecture material. So that part, I think it was fairly intuitive. Yeah, I wouldn't have any negative comments about e-Class.*

Non-curricular aspects

The final factor that greatly affected the student experience in the online course involved non-curricular aspects that are not readily measurable and are not necessarily easily incorporated during the curriculum design process. Some examples of these non-curricular aspects are informal social interactions with others and the intersection of student executive skills, such as time management and motivation, with their learning experience.

When students were asked what they thought was missing from the online asynchronous course, they responded with comments about non-curricular aspects.

> *Human interaction. Because on top of listening to the instructor and having your questions answered you do also have your classmates that you talk to before and after... you simply don't have that in the same capacity with an online class, whether it be synchronous or asynchronous.*

> *The personal aspect of being in class, the time-management aspect of being in class. It's not fun sitting in front of a computer all day doing lectures only to go home and sit in front of a computer, only to still be at home sitting in front of that same damned computer all day trying to find the energy to study now too, you know, to have that break, to see people, to move around a classrooms, to be in a different location, it—it changes the learning experience for me.*

> *I guess that it would just be, like you talking to people and the friends that you don't get to see, but I think that's more of an issue if you were a first year [student] and you didn't get to see, you didn't get to form your friends initially. But like once, after that first year, you've formed your friends and then you know that you're going to be hanging out with them afterwards. So, I don't think it's that big of an issue anymore, but yeah, I think it's more of an issue for the first years, whenever they're coming in, they haven't like met anyone yet.*

Students indicated that the sense of connection between students and between students and instructors served as motivators and could help students be accountable for their learning. Students recognized that this social dimension was weaker in the asynchronous, online environment and so preferred face-to-face contact for the sense of connection and motivation it affords.

> *I find like when I'm at school, I'm just sort of—have like my blinders on and it's just easier to just get in the zone and just do it. And then also, having other people around, you just have a bit of the aura or whatever you want to call it, of just like "We are here to work."*

> *[Students] just feeding off the professor's energy whereas online, you can see their faces, just listening to them, it's kind of boring.*

> *Getting in a class atmosphere and stuff that makes you like want to learn more.*

In contrast, students also recognized that interactions with instructors could be facilitated in an online environment, particularly in terms of one-on-one informal interactions.

> *I find that office hours are easier to attend and maybe a little bit less intimidating to attend when they're in the online format. It's like going to someone's office when you feel vastly unprepared—you know, like you go into [the course coordinator]'s office, for example, like if you know that she's been researching a lot of the stuff for ages and she's really, you know, in depth, so going to in-person office hours to ask a question that, you know, feels kind of stupid. Like it's very intimidating and honestly, I don't go, because it's just kind of weird. I feel like for—Zoom office hours, for example, it's a lot more accessible. They just like pop in for five minutes and it doesn't feel as weird.*

> *I know most of the profs but like for the first years and stuff I can imagine how intimidating that would be.*

Individual student executive functioning also seemed to impact their experience with the online course. Students varied widely in their time management skills and internal motivations. Several students indicated that the asynchronous nature was challenging in terms of progress and motivation, which may be better facilitated in a face-to-face forum. These students indicated that they relied on extrinsic motivators such as formal exams to solidify their learning, which were not part of the online course assessments.

> *We had five weekly quizzes that were open book only for that week's material, which frankly I feel like I didn't learn anything in the course because you look at your notes, you don't study, you don't take the time to memorize or try to understand the concepts.*

> *I was able to understand the material but I didn't feel like I really knew it before the quiz because I didn't feel like I needed to know it.*

Similarly, a number of students also indicated that extrinsic motivators such as peer pressure were important for their success. Students stated that they struggled with focus while trying to learn the material without their peers present, and this was exacerbated by the reduced interactions in the online asynchronous format.

> *...because there's no peer pressure of being in a classroom and because you kind of need the peer pressure to stay focused.*

> *...being able to keep myself motivated and focused and on track [online], versus showing up at school and having the instructors in essence showing up and keeping us on track with regards to time management. So in general I am not a fan of online learning.*

DISCUSSION

This quantitative study showed high Likert scores (4.3 on a scale of 5), with a slight standard deviation, for flexibility and the course-load-related questions, indicating student satisfaction with the load and pace of the online course. However, a larger standard deviation was found in questions about "what is missed" in online learning, compared to a face-to-face environment, indicating variation in student perspectives. Individual interviews were conducted to explore students' online learning experience further, focusing on their perspectives on "what seems missing" in an online course.

This study revealed 3 intersecting elements—course structure, communication, and non-curricular aspects—as major factors affecting the student experience. All 3 factors are supported by different learning theories.

The course structure, including the asynchronous format, the spacing, and the type of assessments, had a strong impact on the student experience. Some students indicated that they appreciated that the frequent quizzes helped keep them motivated and "on track". This observation is supported by the behaviorism learning theory, which postulates that learning is driven by rewards and punishments,[13] in this case, with the reward or punishment being the grade received.

The responses from the participants demonstrated both pedagogical and andragogical learning principles, consistent with the transition from youth to adult learners[6] that is expected with the age of this cohort. Some students preferred teacher-led learning with the instructor providing external motivators such as traditional exams and schedules, while others preferred a more self-driven andragogical approach. Generally, it was noted from the interviews that students who were driven to learn from internal motivations had better learning experiences with the asynchronous online course.

Student comments on the significance of the social context in their learning are consistent with the constructivist approach. Interactions with peers are a consuming and critical part of their identity as emerging adults, and learning experiences that build or enhance these relationships can be of benefit.[6] Harasim[14] proposed an online collaborative learning theory based on constructivist approaches that stresses the importance of peer–peer learning in instructor-led courses. Additionally, Warburton[15] has indicated that the lack of social interactions can be a major barrier in online learning. The

social aspect of learning is also emphasized by Brown,[16] who postulated that students who felt that they belonged to a learning community were committed to their own learning and the learning of their peers. It has been cited that a social presence is necessary for the establishment of an online community.[17] The particular cohort in this study had met, interacted with, and established relationships with their peers and instructors in person before taking the online course, suggesting that social presence and a learning community may have been in place prior to this particular course. However, as some participants noted, first-year students in an online course would not have had prior relationships with their class and/or instructors and, thus, may have struggled more with their learning in the absence of these connections.

The asynchronous nature of the course may also make interactions with the instructor more challenging. Despite the synchronous office hours, there were fewer interactions between students and instructors than there would be in a face-to-face course. Vygotsky's[18] theory of learning postulates that knowledge is constructed during interactions with others. In the format of this particular course, the onus was on the students to initiate these interactions. Less self-driven students may consequently have fewer interactions, which could affect their learning experience. More varied and immediate interactions, such as through instant messaging,[19] SMS messaging[19] or video feedback[20] have been proposed to facilitate more immediate feedback and ease interactions between students and instructors. However, increased social presence does not necessarily lead to improved learning, and in one case, live video conferencing actually led to less favourable learning outcomes when compared with asynchronous forum discussions.[21]

Increasing the immediacy of interactions[22] is also believed to facilitate the development of an online community of learning. Students indicated that the inability to have their questions addressed while learning the material in asynchronous courses was a barrier to their learning. Even with the ability to email, post their questions on the LMS forum, and attend synchronous office hours, learning may be impacted by the delay in response.[23-25] Reciprocally, instructors may not have a sense of the class' understanding of the material because of these delayed interactions. As technologies are increasingly being incorporated into teaching, more immediate modes of communication, such as instant messaging or text messaging, may provide more rapid communications. However, this would nevertheless be reliant on compatible schedules between the student and instructors in asynchronous courses. Though immediacy was clearly an issue in the student experience, there is conflicting evidence of how it actually affects student learning,[26–28] depending on the type of learning done. Several studies reported that, although immediate feedback is more beneficial for class-based activities, quizzes, and list learning, delayed feedback is better for content acquisition and learning difficult items. The possible reasons could be that receiving a delayed response allows students a longer time to process and reflect on the material.[29,30]

Limitations

Individual interviews were conducted several months after the online course was completed. Because of this delay, 2 datasets were removed, as students were confused and mixed up information between courses. The study did not collect demographic data from the participants. Although 55% of the class participated in the online survey, the survey results may not represent dental hygiene students at all year levels. This study included data from one institute only. The perceptions of educators who taught this online asynchronous course were not sought.

CONCLUSION

This study found that the student experience in an asynchronous, online course was influenced by the structure of the course, the communication of the learning objectives and expectations, as well as by non-curricular aspects such as student executive functioning and the social aspects of learning. It is important to recognize that, though students may not like the more self-directed nature of asynchronous courses, the increased student responsibility for and independence of learning can foster an adult learning mindset that is critical for the lifelong learning necessary for health professionals in a rapidly changing practice. Future studies should explore, compare, and contrast student perspectives between different institutes and program years. Studies investigating the experience of instructors who teach online courses may be valuable as well.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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