



Pedagogical Integration Within a Large Anatomy Course: Student and Faculty Perspectives

ABSTRACT

Multiple topics taught together, with the relationships between those topics made explicit, is known as integration; it can be categorized as horizontal integration of topics within a given course or curricular year or vertical integration of topics across years. In this case study, we applied a three-part curricular model to investigate the extent of horizontal integration of topics in the intended, enacted, and experienced curricula of a large first-year dental school team-taught course, which consists of large group lectures and small group labs. We collected data from the course syllabus, exams, student and faculty surveys, and a faculty focus group interview. Findings from the enacted and experienced curricula indicate that this course successfully integrates the lecture and lab components as well as the different topics taught throughout the semester. The intended curriculum, specifically the syllabus, has less evidence of horizontal integration. Positive factors that contribute to the effective integration are repetition of information throughout the course, reinforcement of lecture information in labs, and communication and collegiality among faculty. Challenges to effective integration mainly fall under the categories of consistency and perceived misalignment of lecture and lab. We identified areas where better communication may help ameliorate such issues. Specifically, the designed integration within the course should be more explicitly explained in the syllabus, so that the intended curriculum more closely aligns with the enacted and experienced curricula. Although the course in this study is an anatomy course taught to dental students, the findings discussed here are applicable to other disciplines.

KEYWORDS

higher education, team-teaching, curricular alignment, mixed-methods, case study

INTRODUCTION

A well-designed academic course is crucial for enhancing student learning outcomes. Two concepts involved in curricular design are pedagogical integration and the alignment of different facets of the curriculum. This article presents a case study of a large team-taught course with the aim to investigate how topics taught by different faculty members are integrated with one another. We use the “intended – enacted – experienced” curricular model to investigate horizontal integration of the various aspects of the curriculum.

The course discussed in this paper is a large (approximately 400 students) team-taught anatomy course that is a required part of the first-year curriculum at the New York University College of Dentistry (NYU Dentistry), a large four-year post-graduate dental school in the United States. Previous studies of this course (Baker, Slott, Terracio, and Cunningham 2013; Lopez, Johnson, Cunningham, Warshaw, and Baker 2022) have shown that it succeeds in effectively teaching anatomy to a large cohort of students, as measured by student opinions, student performance in the course,

and student performance on national board exams. Personal conversations with faculty members have revealed anecdotal evidence that instructors feel that the success of the course is a direct result of the integrated course design. Our goal in this study is to more objectively investigate the extent of horizontal integration within this course. We must start with the assumption that individual faculty members and students may have different perceptions and experiences while participating in the course. To investigate the perspectives of the various participants, we need to use methods that can gather data on the participants' points of view.

This study is best situated within a constructivist paradigm. This paradigm claims that there is not a single knowable reality; rather, reality is socially constructed by individuals. Therefore, to investigate reality and construct knowledge, researchers must consider the perspectives of the participants as well as the interactions between participants, society, and the researchers themselves. In this study, we will examine the data provided from multiple sources then use inductive reasoning to draw conclusions about the anatomy course as a whole (Creswell 2015).

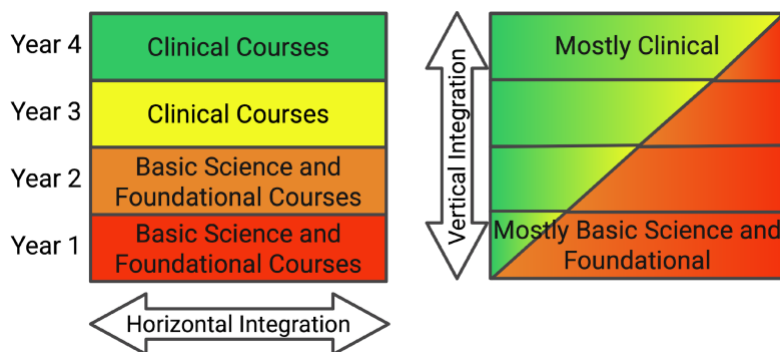
Background

In this section, we will provide a brief overview of pedagogical integration, team-teaching, and the three-part curricular model.

Pedagogical integration

Multiple topics taught together, with the relationships between those topics made explicit, is known as integration (Brauer and Ferguson 2015; Harden, Sowden, and Dunn 1984; Mathur, Mathur, and Saiyad 2019; Wijnen-Meijer, van den Broek, Koens, and ten Cate 2020). An integrated curriculum can be seen in opposition to one where the teaching of each subject is restricted to a certain block of time, such as a lecture, a unit of a course, or a course (Harden et al. 1984). Pedagogical integration can be described as horizontal integration or vertical integration (Figure 1).

Figure 1. Horizontal vs. vertical integration in a health sciences curriculum



Horizontal integration involves topics traditionally taught during a given year (for example, anatomy, histology, physiology in one of the first two years or general surgery and internal medicine within one of the final two years). Vertical integration involves teaching clinical and foundational topics together. (Modeled after Figure 3 in Mathur et al. 2019.)

Horizontal integration refers to integration across topics within a finite period (Brauer et al. 2015). In health science programs, it refers to integrating the basic science subjects and pre-clinical foundational courses with one another during the same year of the program (e.g., year 1 in Figure 1; Mathur et al. 2019). Vertical integration refers to integration across topics that were previously taught

during different time periods (Brauer et al. 2015). In health science programs, it involves teaching basic science and clinical concepts together (Wijnen-Meijer et al. 2020).

Within the health sciences, there is a growing shift toward pedagogical integration of topics. The traditional health science curriculum taught basic science and foundational courses first (anatomy, biochemistry, cell biology, etc.), followed by clinical courses (pathology, surgery, etc.). This model was widespread in medical and dental schools by the early twentieth century (Flexner 1910; Flood 1939; Gies 1926; Goodwin 1934; Tedesco 1995). However, in light of empirical evidence that using an integrated curriculum improves student understanding and performance (Van der Veken, Valcke, De Maeseneer, Schuwirth, and Derese 2009; Wijnen-Meijer et al. 2020; Woods, Brooks, and Norman 2005), relatively recent movements call to modernize and integrate curricula within both medical schools (Bandiera, Boucher, Neville, Kuper, and Hodges 2013; Hopkins, Pratt, Bowen, and Regehr 2015) and dental schools (Crawford et al. 2007; Kassebaum, Hendricson, Taft, and Haden 2004; Pyle 2012).

The subject of pedagogical integration is especially important to current dental education curricula in the United States, as dental students now need to take the Integrated National Board Dental Examination (INBDE) in order to become board certified. First given in 2020, the INBDE replaced the NBDE Parts I and II, which were discontinued in 2020 and 2022, respectively (Christensen 2023). This exam expects students to integrate their clinical and basic science knowledge in order to answer clinically relevant questions. American dental schools are adapting their curricula to prepare students for the new board exam format (Canares, Hsu, Majstorovic, and Noonan 2023; Duong, Cothron, Lawson, and Doherty 2018; van der Hoeven, El Hachem, Chaudhry, Holland, and Shepherd 2021; Wright, Killewo, Dunn, and Dragan 2022).

Team-teaching

Team-teaching involves faculty working together to help students learn. It can involve varying levels of cooperation among faculty on a continuum going from separate teaching roles to simultaneous teaching in the same classroom (Buckley 2000; Perry and Stewart 2005; Sandholtz 2000). The term co-teaching can describe the latter end of the spectrum, in which instructors are working together in the same classroom (Roth and Tobin 2004; Rytivaara, Pulkkinen, and Palmu 2023; Scherer, O'Rourke, Seman-Varner, and Ziegler 2020; Thousand, Villa, and Nevin 2006). The level of team-teaching that typically occurs in the first-year courses of this four-year program is closer to the former end of the spectrum: lecturers typically do not teach in the same classroom simultaneously.

Team-teaching can be beneficial for faculty and students. Faculty can improve teaching practices through collaboration (Shibley 2006) and reduce classroom hours when not co-teaching (Garran, Aymer, Gelman, and Miller 2015). Students gain from exposure to diverse perspectives and expertise (Plank 2011). However, team-teaching can pose challenges for course design. Firstly, while team-teaching can reduce the teaching load of an individual faculty member, it can be resource-intensive and requires strong communication, shared expectations, and a common pedagogical approach (Garran et al. 2015; Perry et al. 2005; Shibley 2006). Secondly, students should be able to understand how distinct but related topics are connected, even if they are taught by different instructors. Ideally, faculty should clarify how their content relates to other course material, other courses in the same year, and potentially courses in subsequent years (in the case of this anatomy course, the relationship of didactic course content to later clinical training is important). Without this coordination, the curriculum may become fragmented, leading to student confusion (Hamo 1994; Mislang 2011). The team-teaching in the course described in this study is rather complicated, since some faculty members only give lectures, some only teach labs, and others do both.

Three-part curricular model

The intended – enacted – experienced curricular model is a framework used to understand the different facets of educational curricula (Bath, Smith, Stein, and Swann 2004; Clemmons, Donovan, Theobald, and Crowe 2022; Matthews and Mercer-Mapstone 2018). It has three components:

1. **Intended Curriculum:** This represents the official plans and objectives set by educational authorities or institutions, detailing what they expect students to learn. It includes policy documents, syllabi, and instructional materials that outline the desired knowledge and skills.
2. **Enacted Curriculum:** This refers to the actual delivery of the curriculum by educators—the teaching methods, activities, and content presented in the classroom. It encompasses how teachers interpret and implement the intended curriculum, which can vary based on their understanding, resources, and context.
3. **Experienced Curriculum:** This involves the learners’ perceptions and experiences of the curriculum—how learners engage with, understand, and internalize the material. It reflects the personal and subjective nature of learning, influenced by individual backgrounds, motivations, and interactions within the educational environment.

Aligning these three components is crucial for effective education (Biggs 1996; Clemmons et al. 2022; Cohen 1987; Porter and Smithson 2001). Discrepancies between them can lead to gaps in learning outcomes. For instance, if the intended curriculum emphasizes critical thinking but the enacted curriculum focuses solely on rote memorization, students may not develop the desired competencies. In this study, we investigate the horizontal integration within this course in the context of each of these curricula. In doing so, we can examine if these aspects of the curricula align with one another. For example, if horizontal integration is emphasized in the intended curriculum but such goals are not enacted by the teaching faculty, this misalignment can be noted and addressed in the future.

Format of the team-taught course

The team-taught anatomy course is situated in the fall semester of the first year of a four-year dental school. The curriculum in the first two years of the program primarily consists of foundational courses, teaching basic sciences and pre-clinical skills. These classes are mainly large lecture-based didactic courses, team-taught by multiple faculty members. Typically, one faculty member is a course coordinator who is responsible for the overall course design (including communication with and coordination of the team of faculty) and the implementation. Lectures are divided by topic, with different topics taught by different faculty members.

This study focuses on a single first-year course in this program (the head and neck anatomy course) and investigates how the teaching faculty horizontally integrate course topics. The course consists of weekly in-person lectures for all students in the course and corresponding small-group labs. It is a large course, both in terms of the number of faculty members involved and the amount of time and resources required. For example, in fall 2023, this 5.5 credit hour course was designed as follows:

1. **Lectures:** Students attend lectures twice per week. Each lecture block is two hours. In total, the course contains 50 hours of lecture, taught by nine different faculty members:
 - Four lecturers who teach most of the course (44 hours)
 - Two lecturers who teach clinical lectures (two hours)
 - Three lecturers who teach the remaining lectures (four hours)

2. **Labs:** Students attend a small-group (approximately 15 students) lab session twice per week. Each lab session is one hour and 50 minutes. Labs are taught multiple times in order to accommodate all the students. Total lab instruction hours across the course are approximately 1000 hours, though each individual student attends 23 lab sessions (about 42 hours).
 - Some overlap exists between instructors for lectures and labs, with six of the nine lecturers also teaching in the lab. Nine additional adjunct faculty members only teach in labs.

Baker et al. (2013) discussed the impact of redesigning the course after a switch from teaching with cadaver dissection to teaching with plastinated prosections. Lopez et al. (2022) described the structure of the course after having to accommodate an increase in the number of students. This course was purposely designed to incorporate repetition of topics across different lectures and across lecture and lab settings and to encourage active learning in small groups in the lab component of the course (Baker et al. 2013; Lopez et al. 2022).

Previous analyses of this course have shown that it provides excellent learning outcomes, as measured by national board exam metrics (Baker et al. 2013; Lopez et al. 2022). We suspect that much of this success is due to the design of the course, specifically the strong horizontal integration of topics. However, it needs to be investigated if this course is well-integrated from the perspectives of the participants (that is, in the experienced curriculum). If there is a discrepancy between what we believe to be true about the course and the evidence uncovered by this study, the findings can be used to improve the student experience in future iterations. We hope that this case study can act as an example for instructors in similar courses, both for how topics can be taught in an integrated way and aspects that may warrant increased attention.

METHODS

The New York University Institutional Review Board approved this study (IRB-FY2024-8227).

Research questions

We used a mixed-methods approach to gather and analyze course documents, student and faculty survey responses, and faculty focus group interview data in order to describe the intended, enacted, and experienced parts of this course. Quantitative data (Likert-type questions and exam metrics) compared quantifiable measures of integration within the course. Qualitative data (course documents, free-response questions, and interview transcript) offered greater context to the quantitative data. Table 1 shows the study's research questions on the horizontal integration in the intended, enacted, and experienced curricula of this course.

Table 1. Research questions and associated data source(s)

	Syllabus	Exams	Faculty data	Student data
Intended	Q1. What does the syllabus say about horizontal integration? (course syllabus)		Q2. What do the faculty members say about intended integration? (survey, interview)	
Enacted		Q3. Do the exams have integrated questions? (exam questions)	Q4. What do the faculty members do? What do they say about how they teach? (survey, interview)	
Experienced		Q5. How do the students do on the stand-alone vs. integrated questions? (exam performance data)	Q6. Do the faculty members experience the course as integrated? (survey, interview)	Q7. Do the students experience the course as integrated? (surveys)

We gathered data to help support or refute our assumption that the head and neck anatomy course successfully intertwines the lecture and lab components as well as the different topics taught by the various faculty members. If our assumption is correct, we expect to see the following (numbers in parentheses refer to questions in Table 1):

- A syllabus that explicitly states the links among topics and between lecture and lab components of the course (Q1).
- Faculty members who say that they plan to teach in an integrated way and mention techniques they use to improve integration (Q2, Q4).
- Exam questions that test two or more topics at a time or otherwise draw on information from more than one lecture or lab (Q3).
- Satisfactory student performance on integrated exam questions (Q5).
- Participants who experience the course as one singular course rather than two separate ones (a lecture course and a lab course) (Q6, Q7).
- Participants who believe that information taught in one context helps inform other topics or aspects of the course (Q6, Q7).
- Participants who mention connections and links between topics or one part of the course reinforcing another (Q6, Q7).
- Students who believe that having multiple faculty members had a positive effect on their experience in the course (Q7).

Course documentary evidence

Documents included the syllabus (which included learning objectives and a lecture schedule) and exam questions. We analyzed the versions of these documents used in the 2023 course.

Student participant perspectives

We sent online surveys created in Qualtrics to all first-, second-, and third-year students via email (see Table 2 for the number of students per year). Students received the surveys in January

2024, one month after the first-year students completed the fall 2023 course, one year after the eligible second-year students completed the course (fall 2022), and two years after the eligible third-year students completed it (fall 2021). (“Eligible students” are defined as the students in the given academic year, apart from “advanced standing” students who did not attend the program during their first year.) The student surveys included a mix of five-point Likert-type questions and open-ended free response questions. We offered students who participated the chance to win a random prize (we randomly selected four students in each of the three cohorts to receive a \$25 gift card).

The survey included questions designed to investigate the extent of horizontal integration within the course (see the four questions about integration and two questions about responsibility for integration discussed in the results section below). It also included questions on horizontal integration across courses within the first year and (for second- and third- year students only) questions on vertical integration with later courses. An analysis of the responses to these additional questions is outside the scope of this study. The full survey can be found in the Appendix.

Given that the first-year students took the course more recently than other cohorts, and presumably could remember more details about the course, their survey had additional questions about their experiences. For example, the first-year survey contained a section asking students about their level of engagement with the course material, the amount that they learned in the course, or their enjoyment of the course. The survey randomly showed questions relating to one of those three topics (rather than all the questions on all three topics) in order to prevent the survey from being too lengthy and burdensome to complete. The surveys for the second- and third-year students had fewer questions and did not include this section.

Faculty participant perspectives

To gather faculty participant perspectives, we sent an online survey and ran a faculty focus group. We sent the online survey created in Qualtrics via email to faculty members who taught more than one hour of lecture or lab in the 2023 course. This survey included a mix of five-point Likert-type questions and open-ended free response questions. We did not offer any incentives for faculty survey completion.

We also invited faculty members who taught in both the lecture and lab components to participate in a semi-structured focus group interview. The focus group lasted for an hour and the author of this paper who does not teach in this course facilitated it in order to reduce potential bias.

Data analysis

As this study took a mixed-methods approach, resulting data consisted of both quantitative and qualitative data. We exported quantitative survey results from Qualtrics and analyzed using JASP (a free and open-source program for statistical analysis). We then compared the student and faculty responses to Likert-type questions to one another using Kruskal-Wallis tests, followed by Dunn’s post-hoc tests when a Kruskal-Wallis test returned a significant result.

Qualitative data included documents (course syllabus and exam questions), text entries into some survey questions, and responses to questions and general discussion via the transcript of the faculty focus group. The focus group took place in person, though we used Zoom to create an audio recording and transcript. We manually exported the transcript, checked and updated for accuracy, and anonymized responses. We then analyzed the qualitative data using MAXQDA. We coded exam questions as belonging to one of three categories: testing only one topic; testing multiple topics, but discretely; or testing multiple topics in an integrated way. The author who did not facilitate the focus group completed all data analysis after anonymization.

We used Saldaña’s (2021) two-stage coding process for the qualitative data. In the first stage, we deductively coded responses to specific questions with a description of the question topic (e.g., horizontal integration, vertical integration, team-teaching), and all text data were read and inductively coded in an in vivo manner. The second stage involved pattern coding in which we grouped the original inductive codes into a smaller number of categories (for example, grouping multiple codes about the lab component of the course into the single code of “lab experiences”). We used idea maps (Figures 3 and 6) to visually represent these categories. We used BioRender.com to create all figures in the results section below.

Response rates

Table 2 shows the response rates to the online surveys. Sample sizes for individual survey questions varied because all survey questions were optional. Approximately 30 to 40 students in each of the second- and third-year classes were “advanced standing” students who did not attend the college during their first year, so the reported response rates are slightly lower than they would be if we excluded students from the overall population. Twelve of the 15 invited faculty (who taught in the course lecture and/or lab in fall 2023) answered most or all of the online survey questions. We invited six faculty members to the focus group, and four of those agreed to participate (66.7%).

Table 2. Sample sizes

	Invited	Answered most or all questions
First-year survey	372	147 (39.5%)
Second-year survey	393	108 (27.5%)
Third-year survey	399	71 (17.8%)
Faculty survey	15	12 (80%)

Sample sizes and response rates for surveys sent to students and faculty members.

RESULTS

Here, we examine the data describing horizontal integration in the intended, enacted, and experienced head and neck anatomy course in 2023. When quotes are included, respondents are identified by their role (faculty or student) and a random alphanumeric identification code that was assigned by Qualtrics or in MAXQDA as part of the anonymization process. Responses associated with the same identification code were from the same person, with the caveat that we are not able to match the identities of faculty members who participated in both the focus group and the survey.

Horizontal integration in the intended curriculum

As outlined in Table 1, we evaluated horizontal integration in the intended curriculum across multiple data sources, namely the syllabus, faculty survey, and interview data.

Syllabus

The intended course curriculum is set forth in the syllabus. The syllabus consisted of a description of the course, overall goals and objectives, course policies and grading, lecture and lab schedules, and learning objectives for individual lectures. Table 3 shows the total count of codes relating to horizontal integration of topics or integration of the lecture and lab components.

Almost every phrase in the syllabus that was coded as related to horizontal integration within the anatomy course referred to integration across topics (e.g., how a topic taught in one lecture relates to a topic taught in another lecture). There were only two times that the syllabus mentioned

integration between lectures and labs, and they were both lists of the learning modalities in the course (see the phrase from the course description in Table 3; there was a similar phrase in the goals and objectives section of the syllabus).

Table 3. Horizontal integration in the syllabus

	Word count	HI coded phrases	Example phrase
Course description	116	1	"In this course, gross anatomy is presented to the students through lectures, study of plastinations, model skulls, digital media, and the introduction of clinical examples and discussions."
Goals and objectives	369	3	"In this course, . . . anatomical relationships are learned and respect and appreciation are developed for the fascinating variation in human structure."
Policies and grading	1916	0	N/A
Lecture and lab schedules	876	6*	"Head and Neck Vasculature" lecture
Lecture learning objectives	4484	31	"The student will be able . . . to describe the anatomically complex region of the pterygopalatine fossa in its interrelationships with the oral cavity, nasal cavity, pharynx, orbit, and cranial cavity." (Objective for lecture on pterygopalatine fossa.)

The number of phrases coded as "horizontal integration within the course" in each section of the syllabus, with an example of each.

* These were names of four lectures and two labs taught toward the end of the course, synthesizing multiple topics.

Faculty data

During the focus group, faculty participants mentioned the intended design of the course (specifically the lecture sequence) as essential for student learning:

You have foundational lectures, and then you go in detail. And it's almost like, if you build, if you're doing a puzzle, you do the outside frame first, and then you kind of fill in little pieces. —Faculty member F3, focus group

The sequence of the lectures is very important. . . . There's a beginning . . . these are some underlying foundational things you need to know. Now we're going to go area by area. Then we're going to look at it as a whole picture again. —Faculty member F1, focus group

Horizontal integration in the enacted curriculum

As outlined in Table 1, we evaluated horizontal integration in the enacted curriculum across multiple data sources, namely the exam questions, faculty survey, and focus group data.

Exam questions

Part of the enacted curriculum is student assessment. Instructors assessed students via three multiple-choice exams in this course. The second and third exams were cumulative and could test on topics tested previously. Subsequent exams had an increasing number of questions that tested more than one topic, either separately or in an integrated fashion (Table 4).

Table 4. Horizontal integration in the exams

	Total questions	One topic*	Multiple topics, discrete**	Multiple topics, integrated***
Exam 1	80	73 (91.3%)	6 (7.5%)	1 (1.3%)
Exam 2	89	64 (71.9%)	7 (7.9%)	18 (20.2%)
Exam 3	110	70 (63.6%)	14 (12.7%)	26 (23.6%)

The number of questions in each of three exams used in the course in 2023, including the count and percentage of questions that tested one topic (i.e., stand-alone questions) and multiple topics (both integrated and non-integrated).

* Example: "Which of the following bones is not in the orbit?" (Topic = bones of the skull)

** Example: "Which of the following statements is true?" followed by five unrelated statements on different topics.

*** Example: "What symptoms would you expect if the facial nerve was damaged in the parotid gland?" (Topics = facial muscles and cranial nerves)

Faculty data

Another aspect of the enacted curriculum is how faculty members teach during the course. Faculty members mentioned repetition of material across the course (in different lectures and during lectures and labs) as crucial to integration. Several mentioned asking colleagues how they taught a topic so that consistent wording could be used when returning to a topic. This is unnecessary when a faculty member is teaching a lab session for a topic for which they are the lecturer:

I think it's easiest [to show students the connections between lectures and labs] when I'm teaching a lab that I've taught the lecture on . . . So I can say, remember when I said x, y, and z. —Faculty member F4, focus group

A similar theme brought up by faculty and students was consistency in content delivery. A faculty member in the focus group interview pointed out that a certain amount of consistency is guaranteed by the course design:

So [having quizzes at the end of each lab] creates a certain commonality across the different labs that people have to at least cover that material. —Faculty member F2, focus group

Horizontal integration in the experienced curriculum

As outlined in Table 1, we evaluated horizontal integration in the experienced curriculum across multiple data sources, namely exam question performance, faculty and student survey data, and faculty focus group data.

Exam questions

We examined how the first-year students performed on the exams mentioned in Table 4. Table 5 shows that the median proportion of correct answers was similar for questions on one topic and integrated questions on multiple topics. The median proportion of correct answers was lower for questions testing multiple topics in a non-integrated manner.

Table 5. Student exam performance

	Number of students	One topic	Multiple topics, discrete	Multiple topics, integrated
Exam 1	371	0.84 (n = 73)	0.74 (n = 6)	0.86 (n = 1)
Exam 2	372	0.93 (n = 64)	0.88 (n = 7)	0.92 (n = 18)
Exam 3	372	0.89 (n = 70)	0.77 (n = 14)	0.74 (n = 26)
Overall median		0.88 (n = 207)	0.77 (n = 27)	0.86 (n = 45)

This table shows the median proportion of students answering questions correctly. Higher proportion (closer to one) means easier questions/more students answering correctly. Median is used due to the non-normality of the data. The sample size (n) in the table is the number of questions in this category.

Faculty and student data—horizontal integration

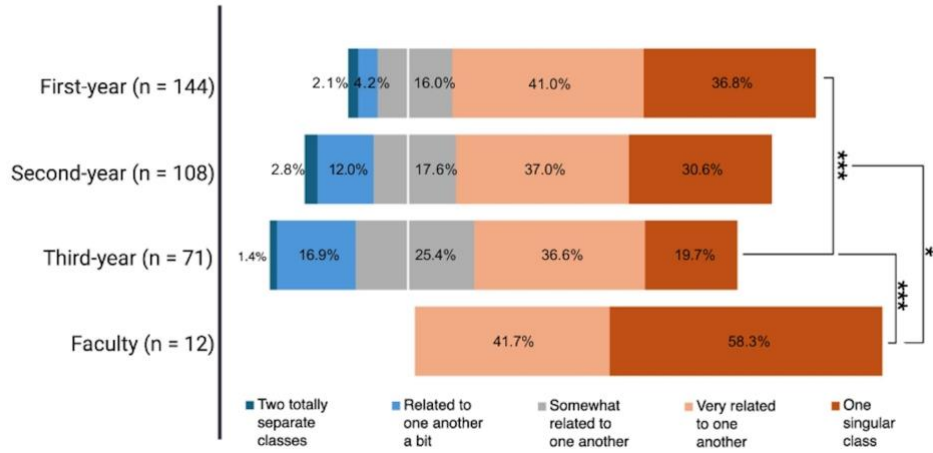
To gauge student and faculty perspectives regarding horizontal integration, similar questions were posed to students and faculty in their respective surveys. Each of the questions listed below could be answered using a five-point scale. The responses to these questions are shown in Figure 2.

- Question 1, faculty and students: Did you consider the anatomy course to be two separate classes: lectures (tested via written exams) and labs (tested via quizzes and practical exam)? Or did you consider the course to be one integrated class? (Figure 2A)
- Question 2S, student perspective: Did information you were taught in a lecture by one instructor help you to understand the information taught in different lectures by other instructors? (Figure 2B)
- Question 2F, faculty perspective: Do you think that the information taught to students in a lecture by one instructor helps them understand the information taught in different lectures by other instructors? (Figure 2B)
- Question 3S, student perspective: Did the information you learned in lectures help you to understand the information you were taught in labs? (Figure 2C)
- Question 3F, faculty perspective: How much do you think that the information taught to students in lectures helps them understand the information taught in labs? (Figure 2C)
- Question 4S, student perspective: Did the information you learned in labs help you to understand the information you were taught in lectures? (Figure 2D)
- Question 4F, faculty perspective: How much do you think that the information taught to students in labs helps them understand the information taught in lectures? (Figure 2D)

Figure 2. Respondents' opinions of course integration

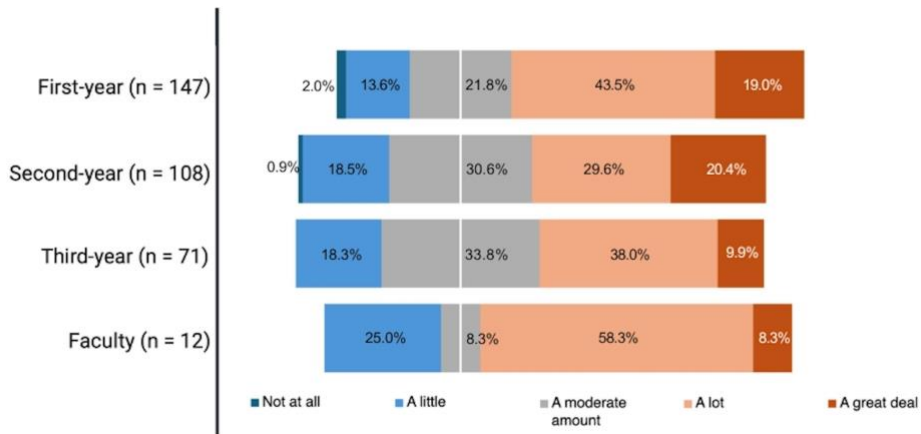
A. Course Integration

$\chi^2 = 18.31, df = 3, p < 0.001$



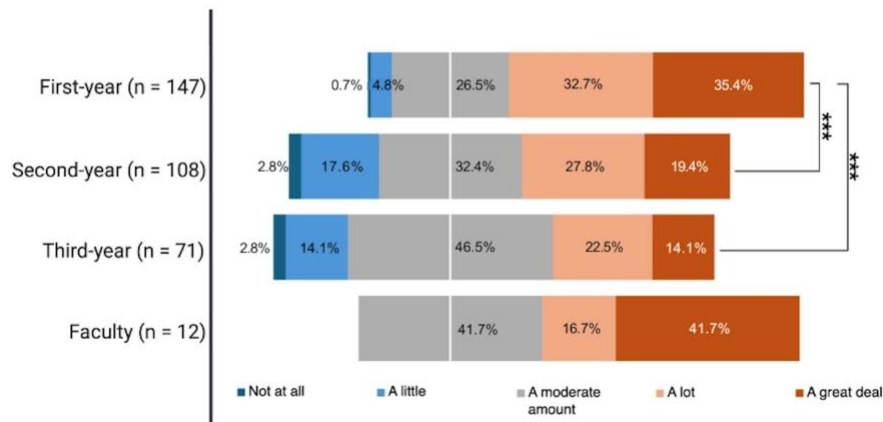
B. Different Lecture Topics

$\chi^2 = 4.10, df = 3, p = 0.251$



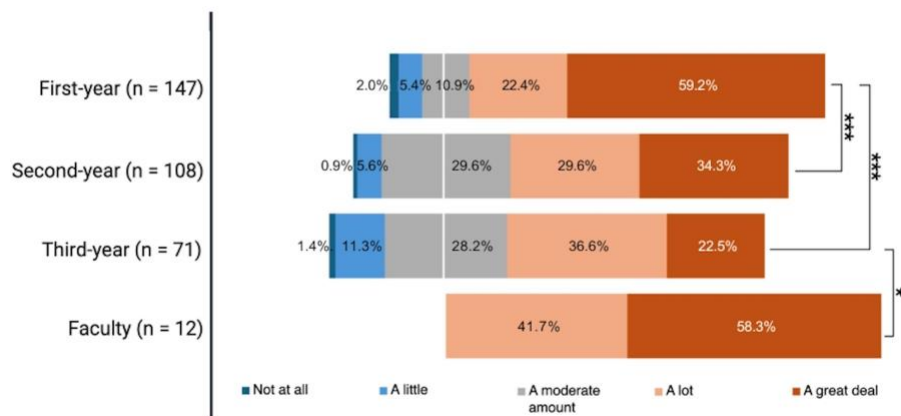
C. Lectures Helping Labs

$\chi^2 = 27.83$, $df = 3$, $p < 0.001$



D. Labs Helping Lectures

$\chi^2 = 31.53$, $df = 3$, $p < 0.001$

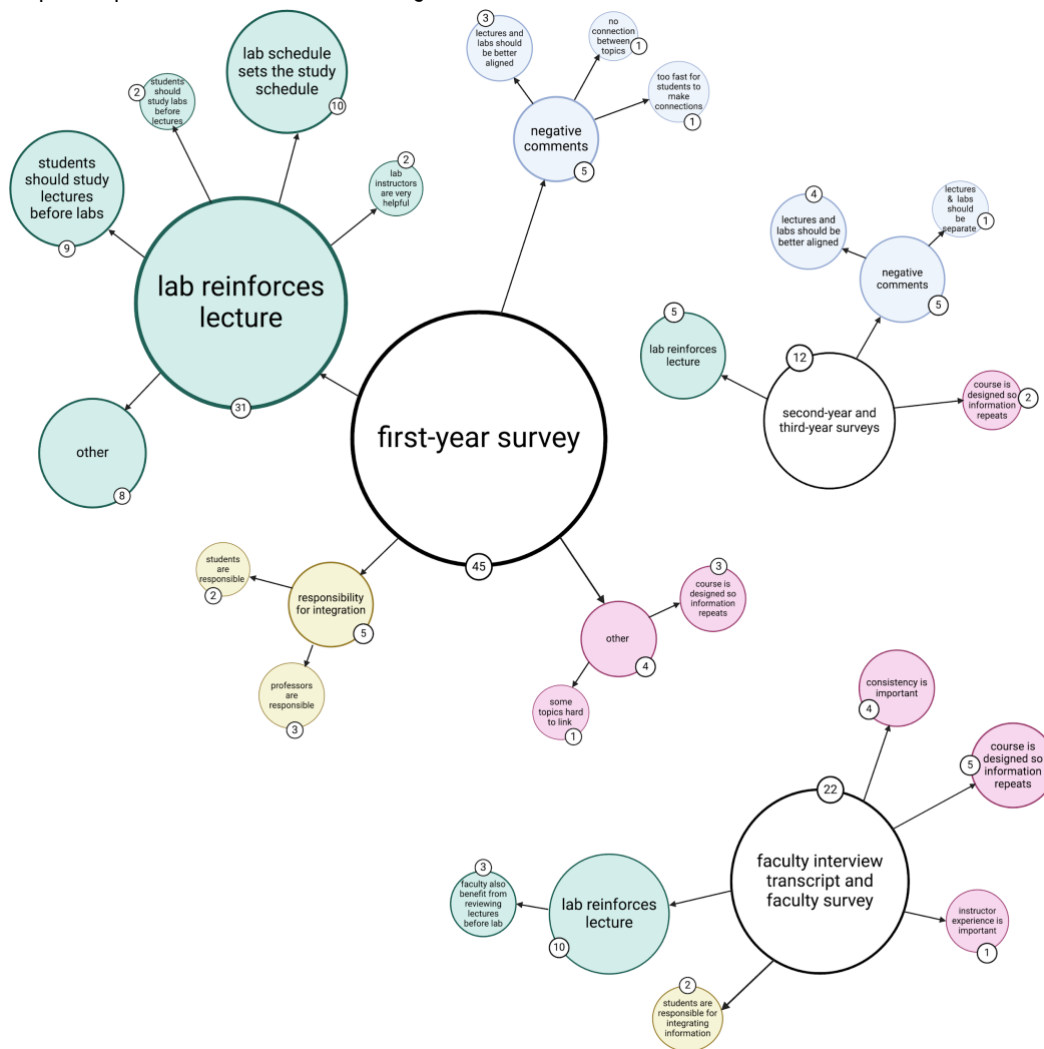


Stacked bar charts showing responses to the questions about course integration. The graphs in A–D correspond to Integration Questions one through four in the text. Neutral responses are anchored by the white line. Kruskal-Wallis test statistics comparing groups are shown under the subheadings A–D, and statistically significant differences between groups are marked by asterisks (Dunn’s post-hoc test; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

In all groups, most respondents answered the questions positively, indicating that they believe that lectures and labs, as well as different lecture topics, are well-integrated with each other. First-year students and faculty members were most positive, while second- and third-year students were less so (in a stepwise fashion). The group responses differed significantly from one another when respondents were asked about the relationship between lectures and labs (Figure 2A, C, D); there were no statistically significant differences among groups when asked about the relationship among lecture topics (Figure 2B).

In addition to the responses on the five-point scale and to the questions listed above, students also had the option to answer free-response questions. Coded responses to the free-response student survey questions and faculty focus group transcript provided additional context and insight regarding horizontal integration within the course. Figure 3 shows a visual representation of all 79 statements that we coded as being related to horizontal integration within the anatomy course.

Figure 3. Map of respondents' statements on integration



Map showing the categorization of survey and focus group statements on the topic of horizontal integration in the head and neck anatomy course. Bubble area is roughly proportionate to the number of responses.

A recurring idea that emerged from these student free-form responses and faculty focus group comments was that students and faculty were overwhelmingly in agreement that the lab component of the course is essential, as information learned in the lab reinforces what is learned in lecture (green bubbles in Figure 3). This supports the positive responses shown in Figure 2D. A second-year student (SSCK) wrote in the survey, “Labs solidified core concepts that were talked about a lot (in lecture and in labs).” Similarly, a faculty member (F3) in the focus group said, “The labs are really reinforcing the lecture, . . . the student hasn’t gotten the full experience until they’ve had the lab.”

On a similar note, faculty posited that it is helpful to introduce students to a topic in lecture and for their understanding of new information to be solidified by interacting with their classmates, instructor, and specimens during the lab session(s). Students also confirmed this sentiment; many participants also agreed that it was helpful to first learn a topic in lecture, then solidify their understanding of that topic in lab: “I did a brief overview of concepts relevant to the upcoming lab

sessions every week to make sure I could get the most out of every session, ask questions, and try to build my long-term memory.”—First-year student SK2J, survey.

I think that having both hands-on work coupled with well-timed lectures (i.e., we first discussed the skull and its anatomy in lectures, and then during the next lab session we had a hands-on exploration and discussion of the skull in person) helped me process the information much better than if it were only one or the other, or if the lectures did not coincide properly with the lab sessions. —Second-year student SkBb, survey

Related to the comments on the relationship between lecture and lab, respondents also mentioned how information repeats throughout the course: “The repetition that was used throughout the course was outstanding to understand head and neck anatomy.” —Faculty member FfbT, survey. “I think repetition, especially throughout lectures, is a key to successful learning.” —First-year student SymB, survey.

A subset of comments on the repetition of information referenced that by the end of the course, information had “clicked” or “solidified” in the minds of students:

The lectures at the beginning of the course tend to be more separate. But as students learn more throughout the semester, they can begin to see how everything fits together. By the end of the course, they should be able to look back at the topics taught in all the lectures and understand the relationships among the different topics. —Faculty member FT2h, survey

It got better as the semester went on, but I attribute that to the material becoming more clear and all of the “pieces” (so to speak) fitting together with more exposure to the material. —First-year student SymB, survey.

Students, but not faculty members, also made negative comments about the horizontal integration within the course. 17.5% of student statements were negative. Some students felt that the lectures and labs did not align (in terms of scheduling, content, or assessment): “Since the lab schedule did not line up exactly with the topics covered in lecture, the course did feel a little disjointed. However, never to the extent that they felt completely separate.” —First-year student Slbl, survey. Another student reflected: “The anatomy in lab was more difficult than in lectures.” —Second-year student SECh, survey.

The survey also asked participants about who was responsible for pedagogical integration in the course. The responses to these questions are shown in Figure 4.

- Question 1, faculty and students: Do you think that it is the responsibility of the instructor(s) or the students to highlight and explain the links between the topics taught in different lectures? (Figure 4A)
- Question 2, faculty and students: Do you think that it is the responsibility of the instructor(s) or the students to highlight and explain the links between the topics taught in lectures vs. labs? (Figure 4B)

Some of the students elaborated on the responsibility for integrating content. One first-year student (Sxxf) said,

Having no prior anatomy experience, I think it's the professor's responsibility to point at the link and the student's to solidify the link. When the information is presented in a discrete form, it gets confusing for a student with little prior experience to make the links necessary or make wrong links.

Another (Sfj0) said, "Since it is our first time learning it is important for the instructor to highlight how their topic fits the bigger picture. It helps us to make those connections and understand the material better."

Faculty members were more likely to mention the processes that students should use to integrate information in their own minds. These included drawing diagrams and making notes covering multiple lecture and lab topics. For example, one focus group participant (F4) said:

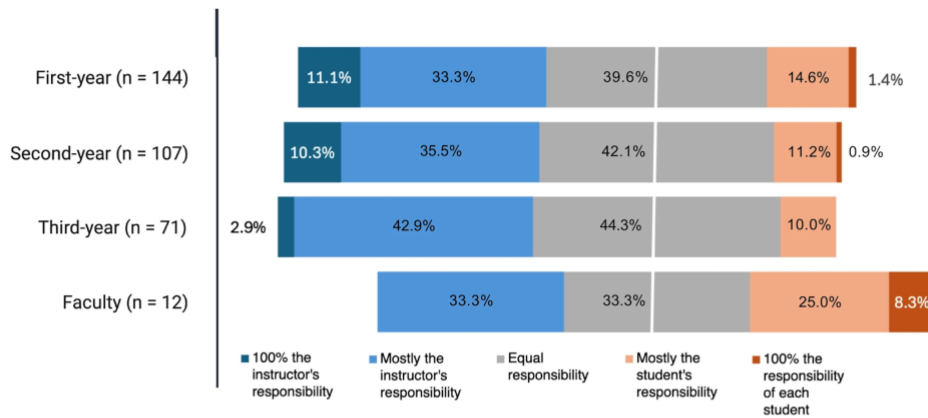
I have seen other, multiple students . . . do things like create a master diagram of all of the arteries. So, the arteries they learned [in]one lecture, and then they add on, and the next lecture they'll add on to the picture. And depending on the person that could be a big time-sink, but I do like that they're taking ownership of this topic and tried to make something.

One of the first-year students (SgDL) mentioned that they do something similar. They explained, "If it was something that overlapped in multiple lectures or complicated, I would draw it out and try to understand it in depth."

Figure 4. Respondents' opinions on responsibility for course integration

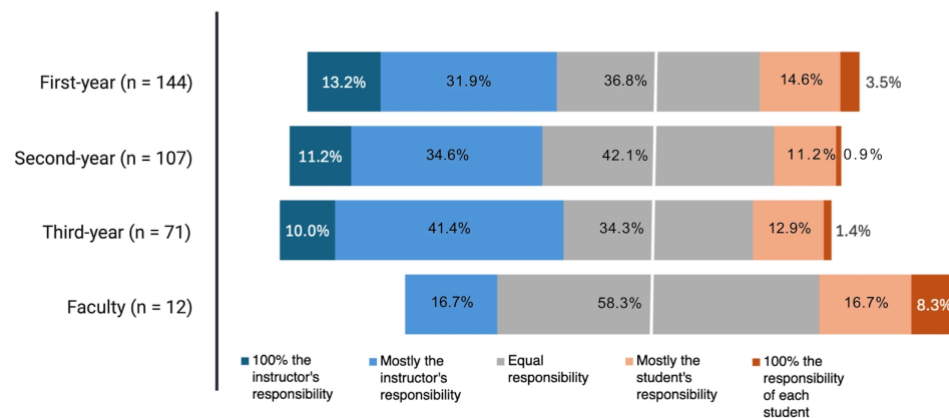
A. Different Lecture Topics

$\chi^2 = 2.57, df = 3, p = 0.463$



B. Lectures and Labs

$\chi^2 = 4.79, df = 3, p = 0.188$



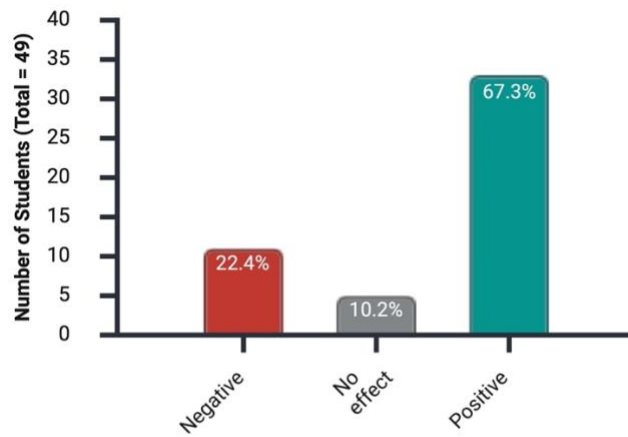
Stacked bar charts showing responses to questions about responsibility for course integration. The graphs in Figures A and B correspond to responsibility questions one and two in the text. Neutral responses are anchored by the white line. Kruskal-Wallis test statistics comparing groups are shown under the subheadings A and B.

Faculty and student data—team-teaching

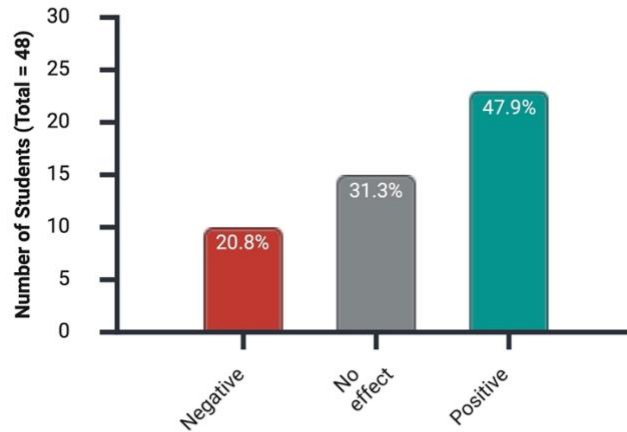
The first-year survey randomly divided students into groups that were shown questions on one of three topics: their level of engagement with the course material, the amount that they learned in the course, or their enjoyment of the course. The survey asked (using a five-point scale) about the effects of having multiple instructors on each of those three measures. The responses were aggregated as a three-point scale (negative, neutral, positive). About two-thirds of the respondents reported that having multiple instructors had a positive effect on their engagement with and enjoyment of the course (Figure 5 A and C). About half of the respondents said that having multiple instructors had a positive effect on the amount that they learned (Figure 5B). Less than a quarter of the respondents thought that having multiple instructors affected them negatively.

Figure 5. First-year students' opinions of multiple instructors

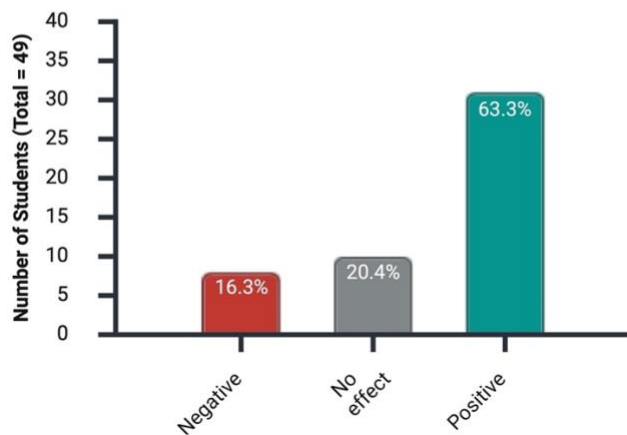
A. Engagement



B. Learning



C. Enjoyment



Bar charts showing responses to questions about how having multiple teaching faculty members affected first-year student experiences in the course.

We coded a total of 48 statements from free-response survey questions and the faculty focus group transcript as being related to team-teaching within the anatomy course (Figure 6). Students and faculty members mentioned that a downside to team-teaching was an inherent lack of consistency. Respondents frequently mentioned the importance of ensuring that student experiences were consistent and standardized: “Repetition of content from one lecture to the next can be a good thing, especially for difficult concepts. Faculty should just coordinate to make sure they are on the same page, using the same terminology etc.” —Faculty member FE6p, survey.

“Multiple instructors meant getting used to different teaching and lecture styles. This meant that when studying this also had to be taken into consideration, which was difficult at times.” —First-year student Ssdn, survey.

“I think what was most difficult was the lack of uniformity across the labs. . . . Lab instructors need to be more standardized.” —Third-year student SdEo, survey.

Another common theme that emerged among students was the benefit of hearing from different perspectives. “For other courses, I personally find it better to have one lecturer. For HN [the Head and Neck Anatomy course], the anatomy is vast so having different explanations and perspectives is ideal.” — First-year student S8YF, survey.

I enjoyed the range of teaching styles I was exposed to as a result of having multiple instructors. It also feels like each instructor is talking about a topic that is in their field of interest and that they are passionate about. —First-year student Slbl, survey

Faculty members mentioned students benefitting from different faculty perspectives as well, but also mentioned more practical aspects of team-teaching, notably sharing the time commitment and being able to develop an expertise in a subset of course topics. “I think the lecture series is very effective because we’ve got a lot of people who have developed really nice lecture material and become experts in those fields. And I think that team-teaching part works really well.” —Faculty member F1, focus group.

I don’t want to be the expert on every lecture. . . . Preparing the lecture in a way that you know you’re doing right by the students is a lot. So, I like that I can say, oh I know [other professor] is going to be covering that, and I cover what I cover. So that’s kind of a really nice thing to share that out. —Faculty member F3, focus group

While it was noted by another faculty member that communication between faculty was even better prior to the 2013 class size increase (and the accompanying increase in number of lab sessions and therefore the number of adjunct faculty teaching in the course), faculty members mentioned a strong sense of collegiality and communication among colleagues, which they felt promoted a good team-teaching environment: “We’re constantly checking in with each other. So that’s huge!” (Faculty member F3, focus group). Students echoed this sentiment. For example, at least one student respondent noticed these relationships. A first-year student (Smdb) said, “I loved how all the instructors worked together as a team to make it a better learning environment for the students.”

Q2. What do the instructors say about intended integration?

Faculty members mentioned that the course design facilitated teaching in an integrated fashion. This was portrayed as an intrinsic part of the course design, as opposed to something that individual faculty members independently chose to do. One exception in the focus group interview was faculty members who mentioned that they asked colleagues about terminology so that instructors used consistent wording. In the future, faculty members can be encouraged to consider their role in presenting the course material in an integrated way.

Enacted curriculum in 2023*Q3. Do the exams have integrated questions?*

There is evidence for enacted horizontal integration in the exam questions (Table 4). Although most exam questions were stand-alone (one topic), the percentage of stand-alone questions decreased as the course progressed (91.3% of exam 1 to 63.6% of exam 3), and there were more topics to integrate. In turn, the percentage of integrated questions increased (1.3% of exam 1 to 23.6% of exam 3).

Q4. What do the faculty members do? What do they say about how they teach?

As mentioned in association with Q2, faculty didn't say much about individual plans to teach in an integrated way, independent of the structure of the course. However, it did appear as if behavior promoting integration arose spontaneously during teaching, often because of the course design.

Faculty members reported that the structure of the course (repetition of topics, labs following lectures on a given topic, multiple quizzes, including ones at the end of each lab) forces a certain amount of integration of topics. They discussed how communication among teaching faculty and how having faculty who teach in both lecture and lab modalities can facilitate integration. Instructors could refer to previous lectures that they taught or direct students to refer to lectures given by a colleague. These findings demonstrate that having faculty who are very familiar with the course structure and content can aid in horizontal integration. If new instructors join the course, there should be a deliberate effort by the course coordinator to help familiarize new instructors with the course as much as possible.

Experienced curriculum in 2023*Q5. How do the students do on the stand-alone vs. integrated questions?*

Student performance on integrated exam questions supports the assumption of a well-integrated course (Table 5). Overall, the median difficulty level for stand-alone and integrated questions were very similar (0.88 for stand-alone vs. 0.86 for integrated questions). Students found questions on multiple topics that were asked in a non-integrated way more difficult (median proportion of students answering correctly was 0.77). Future analyses could explore reasons why students did more poorly on these types of questions. Perhaps being asked about multiple topics in a discrete manner increased the cognitive load associated with the question.

Q6. Do faculty members experience the course as integrated? Q7. Do the students experience the course as integrated?

Overall, students and faculty members agreed that from their respective experiences, the course was well-integrated. Survey respondents said that the course felt unified (rather than separate lecture and lab courses), that lectures covered interconnected topics, and that the information taught

in the lecture and lab parts of the course complemented one another (see the large percentage of responses to the right of neutral in Figure 2).

Overall, students and faculty members agreed on the importance of the laboratory component in solidifying course knowledge and of repetition of information to reinforce knowledge. These results align with the cognitive-constructivist theories of learning which describe learning as happening when students construct knowledge (Derry 1996; Peters 2000; Phillips 1995; Vygotsky and Cole 1978). To do so, students must incorporate new information into existing schemas in their mind, which transforms and enriches those schemas, therefore constructing knowledge and understanding (Chabeli 2010; Derry 1996; Peters 2000; Schmidt and Mamede 2020; Vygotsky et al. 1978). This theory describes how students may be learning while working with their classmates in the anatomy lab component of this course (Erbil 2020). The laboratory component can also be viewed in light of Kolb's learning cycle. The scheduling of lab sessions following lectures (and bookended by quizzes before and after labs) and the elaboration on earlier topics in later stages of the course provide examples of Kolb's cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb 1984).

While it was not a sentiment expressed by faculty, some students suggested that lectures and labs could be better integrated. Several of these students mentioned scheduling issues (e.g., "There were times where the lab did not coincide with the lecture schedule, so we would be exposed to things for the first time in lab." —second-year student S7eF). However, all lab sessions in the course—apart from the very first lab covering general osteology—occurred after at least one lecture on the same topic. Introducing additional explanations of the course structure—in the syllabus or elsewhere—might help students see the relationship between lectures and labs.

When asked about who was responsible for explaining the links between lecture topics or between the lecture and lab components of the course, students and faculty responses did not show any statistically significant differences. Most responses suggested that students and faculty members share responsibility (see the gray, light blue, and light orange bars in Figure 4). Despite this overlap, student and faculty responses skewed in different directions. The three classes of students answered similarly to one another, veering toward faculty responsibility for integration. Faculty tended to suggest that students had more responsibility. The lack of significant differences between faculty and students may be due to the low sample size of faculty members. Some of the students explicitly stated that faculty members are responsible for pointing out the links between topics. The students, correctly realizing that the faculty members are subject matter experts, are asking for guidance in the process of constructing their knowledge of this new-to-them field.

Overall, the first-year students expressed that learning from multiple instructors had a positive effect on their engagement with the course, the amount of information that they learned, and their enjoyment of the course. A few respondents reported that having multiple instructors affected them in a negative way. Although the majority of students appeared to appreciate the benefits of team-teaching (especially being exposed to different perspectives and opinions), many students expressed concern about a lack of consistency across different lecturers and lab instructors. Several students said that variations in lecture style and slide design made it difficult to study. This could be explained by the fact that adapting to different presentation styles may increase the students' cognitive load. Faculty members in the course have not previously considered standardizing their lecture presentations but doing so may help reduce the cognitive load on students (Hadie Haji et al. 2023; Jordan, Wagner, Manthey, Wolff, Santen, and Cico 2020; Tsai, Wallace, and Pinder 2021).

Finally, faculty members had a more practical appreciation for team-teaching, because it allowed them to share the workload and it enabled lecturers to develop expertise related to their

lecture topic. Colleagues felt comfortable referring students to the subject matter expert for a specific course topic when necessary.

Limitations and future research

A notable limitation of this research is the dual role of one of the authors as both a course instructor and researcher. This author's familiarity with the curriculum design and course participants may lead to unconscious biases in data interpretation and analysis. We attempted to ameliorate such biases by having the other author lead the focus group interview and by analyzing only anonymized data. However, our identities as faculty members may mean that we have made unconscious assumptions or have overlooked alternative perspectives and conclusions.

The lack of interview data from students served as an additional limitation. We gathered both survey and focus group data from faculty members but not from students. This means that the student responses must be read on their own, without the ability to ask questions or gather additional nuanced information.

This study could not explain why there were differences in the responses from students in different years. Considering the variation in responses across the three different groups, we plan to follow up with a longitudinal study over several years in order to determine if the observed pattern holds or if student opinions remain stable over time.

We would also like to follow up on this study of a single course by investigating whether students and faculty members involved in similar courses in the four-year curriculum have comparable experiences with horizontal integration in those team-taught courses. Future studies may also investigate the factors influencing vertical integration with the curriculum.

CONCLUSIONS

This study's findings support our assumption that the head and neck anatomy course at NYU Dentistry is a well-integrated team-taught course from the perspectives of the student and faculty participants. Students and faculty responses suggest that the lecture and lab components of the course as well as the different topics taught in lectures and labs are all well-integrated with one another. We found that students and faculty members were more likely to experience the class as one singular course, rather than separate lecture and lab, and they reported that information taught in one context could help them understand those same concepts in another context. The repetition of information in lectures and associated labs, as well as across the duration of the course, contributes to these findings.

The course design played a major role in the student and faculty view of horizontal integration in this course. Study participants mentioned repetition of information lectures, but were most enthusiastic about how labs reinforced information previously taught in lectures. The instructors purposely included this repetition in the course, and designed the labs based on the theories of spaced repetition, frequent testing, and small group learning (Baker et al. 2013; Lopez et al. 2022).

One area of the course that could use improvement is an increased emphasis on horizontal integration in the syllabus. The syllabus does not explicitly address the important link between the lecture and lab components. Adding this explanation to the syllabus could help address the perception of some students that lectures and labs were not aligned optimally.

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APPENDIX

We sent the survey below to the first-year students who completed the anatomy course in 2023. The questions with multiple-choice answers shown were Likert-type questions. The questions with no answer choices had a text box for respondents to enter text. We sent similar survey questions to second-year students, third-year students, and faculty members; these are noted below. Note that some survey questions mention D1, D2, or D3 years; these correspond to the first three years of the dental school curriculum.

First-year survey questions

The following questions are about your experiences in the D1 Head and Neck Anatomy course in fall 2023.

Attendance

1. How often did you attend lectures in person?

- Never (1)
- Sometimes (2)
- About half the time (3)
- Most of the time (4)
- Always (5)

2. How often did you attend labs in person?

- Never (1)
- Sometimes (2)
- About half the time (3)
- Most of the time (4)
- Always (5)

3. Any additional comments about how often you attended lectures or labs?

Resources Used

4. Which of the following resources did you use to learn the content in this course?

	Never (1)	Sometimes (2)	About half the time (3)	Most of the time (4)	Always (5)
Face-to-face lecture attendance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture recordings from the current year	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture recordings from previous years	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture slides (without going to lecture)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cerego modules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specimens in lab	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Textbooks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workbooks posted on Brightspace	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practice questions posted on Brightspace	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. Any additional comments on the resources you used to learn the information in this course?
Studying and Scheduling

6. When preparing for exams, did you study the topics over an extended period of time or did you cram shortly before each exam?

- Always crammed before the exams (1)
- Mostly crammed (2)
- Mix of strategies (3)
- Mostly spaced out studying (4)
- Always spaced out studying (5)

7. Did the course instructors influence your studying **strategies**? Please explain.

8. Did the course instructors influence your studying **schedule**? Please explain.

9. What impact did each of the following course design elements have on your studying **strategies**?

	No impact on studying strategies (1)	Very little impact on studying strategies (2)	Moderate impact on studying strategies (3)	High impact on studying strategies (4)	Very impactful on studying strategies (5)
Lecture Schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture/Powerpoint Slides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cerego Modules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Podcasts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab Schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pre-lab Quiz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Post-lab/Exit Quiz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. What impact did each of the following course design elements have on your studying **schedule**?

	No impact on studying schedule (1)	Very little impact on studying schedule (2)	Moderate impact on studying schedule (3)	High impact on studying schedule (4)	Very impactful on studying schedule (5)
Lecture Schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture/Powerpoint Slides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cerego Modules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Podcasts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab Schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pre-lab Quiz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Post-lab/Exit Quiz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Did the course design (including the lab schedules, quiz schedules, Cerego modules, or anything else) influence your studying strategies and schedule? Please explain.

12. Any additional comments on how the course was designed?

Engagement/Learning/Enjoyment

{The students were randomly shown questions on one of the three topics mentioned in the questions below.}

The following questions ask about your feelings of **engagement** in the course. Think about if you participated in the course, if you felt interested in the material, if you were excited to understand the concepts taught in the course, if you felt comfortable interacting with your classmates and instructors, and if you completed assignments. Each of these factors is related to student engagement.

13. How much did you feel engaged with the Head and Neck Anatomy course as a whole?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

14. How much did you feel engaged with the *lectures* in the Head and Neck Anatomy course?

The following questions ask about your feelings about **learning** in the course. Think about if you felt that you learned the appropriate amount of information during your time in the course. How much knowledge and understanding of anatomy did you have at the end of the course compared to the beginning of the course?

13. How much did you learn from the Head and Neck Anatomy course as a whole?

- Nothing (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

14. How much did you learn from the *lectures* in the Head and Neck Anatomy course?

- Nothing (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

The following questions ask about your feelings of **enjoyment** in the course. Think about if you enjoyed the course and the material that was taught. Did going to class and studying make you feel happy and proud of yourself (even if the material was difficult) or did you feel unhappy?

13. How much did you enjoy the Head and Neck Anatomy course as a whole?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

14. How much did you enjoy the *lectures* in the Head and Neck Anatomy course?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

15. How much did you feel engaged with the *labs* in the Head and Neck Anatomy course?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

15. How much did you learn from the *labs* in the Head and Neck Anatomy course?

- Nothing (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

15. How much did you enjoy the *labs* in the Head and Neck Anatomy course?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

16. Any additional comments on your feelings of engagement with the course?

16. Any additional comments on the amount that you learned in the course?

16. Any additional comments on your enjoyment of the course?

17. The lectures in this course were taught by multiple instructors. How did having multiple instructors affect your engagement with this course?

- Very negatively (1)
- Slightly negatively (2)
- Didn't affect it at all (3)
- Slightly positively (4)
- Very positively (5)

17. The lectures in this course were taught by multiple instructors. How did having multiple instructors affect your learning of the material in this course?

- Very negatively (1)
- Slightly negatively (2)
- Didn't affect it at all (3)
- Slightly positively (4)
- Very positively (5)

17. The lectures in this course were taught by multiple instructors. How did having multiple instructors affect your enjoyment of the material in this course?

- Very negatively (1)
- Slightly negatively (2)
- Didn't affect it at all (3)
- Slightly positively (4)
- Very positively (5)

18. What was your level of engagement in this course, compared with other courses

18. What was your level of learning in this course, compared with other courses

18. What was your level of enjoyment in this course, compared with other courses

taught by multiple instructors
in your D1 year?

- Much worse (1)
- Slightly worse (2)
- About the same (3)
- Slightly better (4)
- Much better (5)

19. Any additional comments
on your experience of how
having multiple instructors
affected your engagement in
this course?

taught by multiple instructors
in your D1 year?

- Much worse (1)
- Slightly worse (2)
- About the same (3)
- Slightly better (4)
- Much better (5)

19. Any additional comments
on your experience of how
having multiple instructors
affected your learning in this
course?

taught by multiple instructors
in your D1 year?

- Much worse (1)
- Slightly worse (2)
- About the same (3)
- Slightly better (4)
- Much better (5)

19. Any additional comments
on your experience of how
having multiple instructors
affected your enjoyment of this
course?

Integration of Lectures and Labs

20. Did the information you learned in *lectures* help you to understand the information you were taught in labs? *{This was also asked of second- and third-year students. The faculty survey asked, “How much do you think that the information taught to students in lectures helps them understand the information taught in labs?”}*

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

21. Did the information you learned in *labs* help you to understand the information you were taught in lectures? *{This was also asked of second- and third-year students. The faculty survey asked, “How much do you think that the information taught to students in labs helps them understand the information taught in lectures?”}*

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

22. Did information you were taught in a lecture by one instructor help you to understand the information taught in different lectures by other instructors? *{This was also asked of second- and third-year students. The faculty survey asked, “Do you think that the information taught to students in a lecture by one instructor helps them understand the information taught in different lectures by other instructors?”}*

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

23. Did you consider the anatomy course to be two separate classes: lectures (tested via written exams) and labs (tested via quizzes and practical exams)? Or did you consider the course to be one integrated class? *{This was also asked of faculty members and of second- and third-year students.}*

- Two totally separate classes (1)
- Related to one another a bit (2)
- Somewhat related to one another (3)
- Very related to one another (4)
- One singular class (5)

24. Do you think that it is the responsibility of the instructor(s) or the students to highlight and explain the links between the topics taught in *different lectures*? *{This was also asked of faculty members and of second- and third-year students.}*

- 100% the instructor's responsibility (1)
- Mostly the instructor's responsibility (2)
- Instructors and students are equally responsible (3)
- Mostly the student's responsibility (4)
- 100% the responsibility of each student (5)

25. Do you think that it is the responsibility of the instructor(s) or the students to highlight and explain the links between the topics taught in *lectures vs. labs*? *{This was also asked of faculty members and of second- and third-year students.}*

- 100% the instructor's responsibility (1)
- Mostly the instructor's responsibility (2)
- Instructors and students are equally responsible (3)
- Mostly the student's responsibility (4)
- 100% the responsibility of each student (5)

26. Any additional comments on the integration of information taught in *different lectures*? *{This was also asked of faculty members and of second- and third-year students.}*

27. Any additional comments on the integration of information taught in *lectures and labs*? *{This was also asked of faculty members and of second- and third-year students.}*

Anatomy and Other Courses

28. How much do you think that the information you learned in Head and Neck Anatomy helped you understand the information you were taught in other D1 courses?

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

29. How much do you think that the information you learned in other D1 courses helped you understand the information you were taught in Head and Neck Anatomy? *{This was also asked of second- and third-year students.}*

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

30. Any additional comments on the integration of information taught in the various D1 courses? *{This was also asked of second- and third-year students but was worded as “Any additional comments on how information taught in various courses are integrated with one another (either within a single year or across years)?”}*

31. Thank you for taking the survey! Any additional information you would like to share? *{This was also asked of faculty members and of second- and third-year students.}*

Additional questions asked of second-year and third-year students (but not first-year students)

32. How much do you think that the information you learned in Head and Neck Anatomy helped you understand the information you were taught in D2 courses? *{For third-year students, this was worded as, "... taught in D2 and D3 courses?}*

- Not at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

33. What DDS courses in D1 or D2 do you think are very well integrated and could be used as a model for other courses? *{For third-year students, this was worded as, "... courses in D1, D2, or D3 ...?}*

Clinical Courses

34. How well did the D1 Head and Neck Anatomy course provide you with the anatomical knowledge that you need for clinical work?

- Not well at all (1)
- Slightly well (2)
- Moderately well (3)
- Very well (4)
- Extremely well (5)

35. Although you probably have not taken the INBDE (integrated board exam) yet, answer the following question as best as you can. How well did the D1 Head and Neck Anatomy course provide you with the anatomical knowledge that you need to be successful on the INBDE?

- Not well at all (1)
- Slightly well (2)
- Moderately well (3)
- Very well (4)
- Extremely well (5)

36. Do you have any additional comments on how well the course prepared you for clinical coursework and patient care?



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