
HAPS Curriculum & Instruction 2022 Laboratory Survey: Demographics of Respondents, Institutions, and Students

Carol A. Britson, PhD¹, Chris Kule, PhD², Rachel Hopp, PhD³, James E. Clark, PhD⁴, Heather Armbruster, MS⁵, Chinenye Anako, MD, MPH⁶, Julia M. Schmitz, PhD⁷, Jeff Huffman, MS⁸, Marnie Chapman, MS, MA⁹, Cynthia Schmaeman, MS¹⁰, Janay Dennis, MS¹¹, and Kathleen Ahles, PhD¹²

¹Department of Biology, University of Mississippi; University, MS, USA

²Department of Biology, Pennsylvania College of Technology, Williamsport, PA, USA

³Department of Biology, University of Louisville, Louisville, KY, USA

⁴Department of Biology, Los Medanos College, Pittsburg, CA, USA

⁵Department of Biology, Southern Union State Community College, Wadley, AL, USA

⁶Georgian Court University, Lakewood, NJ, USA

⁷Department of Biology, Piedmont University, Demorest, GA, USA

⁸Department of Biology, Salt Lake Community College, Salt Lake County, UT, USA

⁹Department of Biology, University of Alaska Southeast, Sitka, AK, USA

¹⁰Department of Biology & Environmental Science, Auburn University at Montgomery, Montgomery, AL, USA

¹¹Department of Biology, Mitchell Community College, Statesville, NC, USA

¹²Department of Biology, University of Texas at Arlington, Arlington, TX, USA

Corresponding author: cbritson@olemiss.edu

Abstract

In 2022, a subset of the Human Anatomy and Physiology Society (HAPS) Curriculum & Instruction Committee administered the third offering of the HAPS lab survey. This survey included a three-part framework of (1) demographics, (2) lab activities and learning outcomes, and, (3) the impact of a global pandemic on instruction. Here we report on demographics of respondents, their institutions, and students. Survey results related to lab activities and outcomes, and COVID-19 impacts, will be addressed in subsequent manuscripts. The duration of teaching service has been stable with 54.3% to 58.3% of respondents serving at least ten years in their current position, and 88% of respondents working at a single institution. Job responsibilities focused on teaching (98.9%) as well as multiple other commitments including service and lab and/or course coordination. The number of respondents with a terminal degree increased and there has been a decrease in the percentage of respondents working at 2-year institutions, with 50% of respondents working at 4-year institutions, of which a slight majority had graduate programs. Career goals of enrolled students remained focused on allied-health and instructors indicated nursing as the most common student career goal, with a range of other careers also mentioned. Overall, the results affirmed the importance of anatomy and physiology (A&P) instruction and the multiple roles that

A&P instructors serve at their institutions. <https://doi.org/10.21692/haps.2023.013>

Key words: anatomy, physiology, education, survey, instruction, faculty, institutions, demographics, fees

Introduction

The laboratory component is an essential element of introductory undergraduate anatomy & physiology (A&P) instruction, as it confers crucial critical thinking and clinical skill sets, complements and applies important lecture concepts, and provides opportunities for “hands-on” collaborative learning opportunities. In an effort to characterize this A&P laboratory experience for students, the Human Anatomy & Physiology Society (HAPS) sponsored

two previous surveys of A&P instructors in 2013 (Brashinger, 2014a; 2014b) and 2017 (Brashinger, 2017). These initial surveys investigated the foundational learning outcomes for A&P laboratory instruction and the best practices for achieving these goals. The 2013 survey provided a baseline of opinions and common practices for the undergraduate A&P laboratory, while the 2017 survey expanded upon this foundation.

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A majority of respondents in both surveys indicated that they used specific laboratory learning outcomes and that having students meet learning outcomes was a high priority. Participants in the 2017 survey responded that their most important laboratory experience priorities were meeting program objectives, teaching three-dimensional and structure/function relationships, and reinforcing lecture content. An intriguing observation in both surveys was the finding that a significant number of instructional A&P laboratory goals were not directly related to laboratory knowledge, as evidenced by the relatively low rankings of clinical knowledge, scientific inquiry, and science laboratory knowledge skills. Future studies suggested by these collective results included determining whether A&P instructional priorities align with entry-level expectations of nursing and allied health programs and investigating how learning outcomes align with laboratory learning experience priorities (Brashinger, 2014a; 2014b; 2017).

With regard to lab activities, the 2017 survey indicated that optical microscopy was the main instructional approach for histology, although digital and print imagery were common (Brashinger, 2017). Also revealed by this survey was the prevalent use of whole preserved animals and preserved organ dissection for anatomy instruction and human subjects for physiology experimentation. Although human anatomical donor dissection and the use of live animals for physiology experimentation were limited, a significant number of 2017 survey respondents reported using prosected human anatomical donor specimens and computer modeling for human dissection instruction. These ranked frequencies of methodologies in histology, dissection and physiology experimentation provided a useful framework for further delineation of best practices in A&P laboratory instruction (Brashinger, 2017).

The Curriculum and Instruction Committee of HAPS was preparing to revise and administer the survey in 2020 following the planned annual conference in Ottawa, ON, Canada. These preparations, like much of 2020, were disturbed by the COVID-19 pandemic, and put on hold while attention was diverted to shifting A&P instruction to a fully remote, online experience. After the HAPS 2021 virtual annual conference, preparations resumed to deliver the survey with added questions about experiences teaching A&P labs during the pandemic.

The lab survey most recently administered in 2022 built upon the foundation of the prior surveys, within an overarching three-part framework (Part I focusing on demographics of respondents and their institutions; Part II addressing lab activities and HAPS learning outcomes/goals, and Part III investigating the impact of a global pandemic on A&P teaching and science instruction in higher education). The current article presents Part I, the demographics data from the 2022 survey, which shared many similar questions with

the previous surveys, while providing an updated profile of the survey participants, the courses they instruct, and the institutions at which they teach.

The objective of Part I was to further delineate aspects of undergraduate A&P instruction in order to provide an appropriately structured context and framework for Parts II and III of the survey, which investigated commonly implemented A&P laboratory activities, the learning goals/outcomes for laboratory pedagogy, and the impact of a global pandemic on this instruction. In addition, select data from Part I will also serve as independent variables for statistical analysis of results from Parts II and III of this survey. Collectively, these three sections of the 2022 survey provide a comprehensive, nuanced, and multilayered portrait of undergraduate A&P laboratory instruction while identifying emerging trends in instruction across a diverse scope of institutions, courses, and educators.

Materials and Methods

During the 2021 HAPS virtual annual conference, the lab survey subcommittee of the Curriculum and Instruction Committee was formed and met to plan for the third administration of the HAPS lab survey. Within the subcommittee, members represented a diversity of institutional types, geographical regions, courses taught, and teaching format. The subcommittee met twice per month from June to October of 2021 to assess the utility of the questions from the first (Brashinger, 2014b) and second (Brashinger, 2017) lab surveys, respectively. We developed the present survey around three categories: demographics of instructors and institutions, laboratory activities and outcomes, and the impact of the COVID-19 pandemic on A&P instruction. Questions from the first and second HAPS lab surveys were seeded into the first two categories allowing for evaluation of temporal changes in A&P lab instruction.

Common questions in the 2013, 2017 and 2022 surveys included professional memberships (with "American Association of Clinical Anatomists" as a new option), highest degree/licensure, duration and employment contract ("full time", "part time", "permanent", etc.) of current position, type of institution (with "graduate program" included for 4-year institutions), student career goals, and lecture and lab instructional format (with "in-person", "hybrid", "synchronous" and "asynchronous" as revised options). Questions on prior surveys regarding position status and job title were reformatted with revised position categories for "job level" and a new question asking what "job duties" the respondents' position included. Likewise, the previously administered question on A&P course sequence duration was presented in our current survey based on course numbering and whether the lecture and laboratory were taken concurrently by students.

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In addition to the common questions detailed above, the 2022 survey also employed several newly written questions, which included the number of institutions at which respondents had taught, undergraduate enrollment at their current institution, the enrollment and number of sections offered per academic year for A&P as well as anatomy-only and physiology-only courses, the use of HAPS exams by respondents in their classes, the laboratory fees students were required to purchase each semester, and external laboratory resources students were required to purchase (“lab manual”, “digital lab resource”, “lab equipment”, etc.). These novel questions provided a layered and multidimensional perspective of the A&P students, instructors and their undergraduate institutions.

To further develop the 2022 survey, subcommittee members volunteered to focus their efforts within one of the three survey categories. Within each category, members represented a diverse range of teaching experiences, teaching challenges, and individual perspectives. The first iteration of the survey was reviewed by the HAPS Board of Directors in 2021. Comments were used to refine the survey in October 2021. In November 2021 the revised survey was sent to four volunteers, who were not involved in the survey subcommittee, to obtain feedback on question clarity and survey length. These naive reviewers stated that the questions were concise and that the survey took 15–25 minutes to complete depending on how many questions applied to their role at their institution. After receiving approval from the HAPS Board of Directors to proceed with the revised survey, Institutional Review Board EXEMPT status was obtained under 45 CFR 46.101(b) (#2) by The University of Mississippi’s Institutional Review Board (IRB, Protocol #22x-129). Respondents were required to verify that they were 18 years of age or older before beginning the survey.

The survey was delivered and publicized through HAPS membership emails, the HAPS listserv communication board, a HAPS Blog (Britson, 2022), and HAPS social media during February and March of 2022. While the survey was anonymous, respondents could choose to enter a gift card raffle by entering their name and email address after submitting their lab survey responses. ADInstruments, Inc. sponsored gift card incentives for respondents completing the survey. One winner of a \$100 gift card, and four winners of \$50 gift cards, were chosen at random at the end of March 2022. At that time, 141 responses had been received. To encourage additional participation, the subcommittee presented a poster (Britson et al., 2022) at the 2022 annual HAPS conference to communicate preliminary findings and offer additional incentives in the form of a door prize raffle. The survey remained open for submissions through August 15, 2022.

For the development of the demographic portion of the 2022 survey, questions asking for information job levels, duties, and type of employment contract, sizes of the respondents’ institutions and classes (both lecture and laboratory), variety of anatomy and physiology courses offered and enrollment requirements, lecture and laboratory instruction formats, and amount of required lab fees were added to the questions seeded from the two earlier surveys. Specific development of the laboratory activities and outcomes, and the impact of the COVID-19 pandemic on A&P instruction survey sections, will be presented in subsequent manuscripts. Linking of demographic data to responses will allow comparisons across institutions and courses regarding how laboratories are taught, how students are assessed, and how anatomy and physiology instruction continued during the COVID-19 pandemic. Frequency data and descriptive statistics were calculated for all survey questions. All statistical tests were conducted using SPSSV27 software licensed to the University of Mississippi.

Results

There were 176 responses to the survey. For respondents who disclosed their location, 29.9% were from the southern region of HAPS, 23.0% from the eastern region, 20.9% from the western region, and 25.1% from the central region (Human Anatomy & Physiology Society, 2023a). A demographic profile of the typical survey respondent showed membership in HAPS and at least one other professional society, a terminal degree, working in a faculty position at a single institution, and employment in their current position for more than ten years. Nearly 70% of survey respondents indicated membership in HAPS (Figure 1). Additional memberships in the American Association for Anatomy and the American Association of Clinical Anatomists were the next most common at 10.8% and 10.2% of survey respondents, respectively. From 2013 to 2022, the proportion of respondents holding a terminal degree increased from 48.6% to 56.9% while the number of respondents with a master’s degree decreased from 44.8% to 31.3% (Figure 2). Length of time in their current positions has been relatively constant across the three surveys with 54.3% to 58.3% (2013 to 2022) of respondents with ten plus years in their current position (Figure 3). Eighty-eight percent of respondents worked at a single institution with 9.71% at 2 institutions, 1.14% at 3 institutions, and 1.14% at more than 3 institutions. Respondents indicated that their positions were considered faculty (91.0%), staff (6.78%), retired/emeritus (1.13%), student (0.56%), or another status (0.56%). No respondent indicated that they were in a post-doctoral position.

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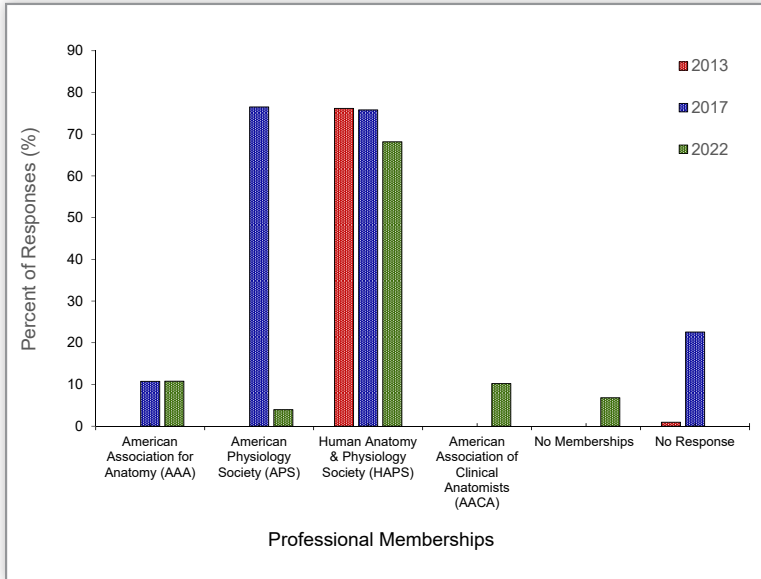


Figure 1. Professional society memberships held by respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply. Where applicable data from the 2013 and 2017 surveys were also included.

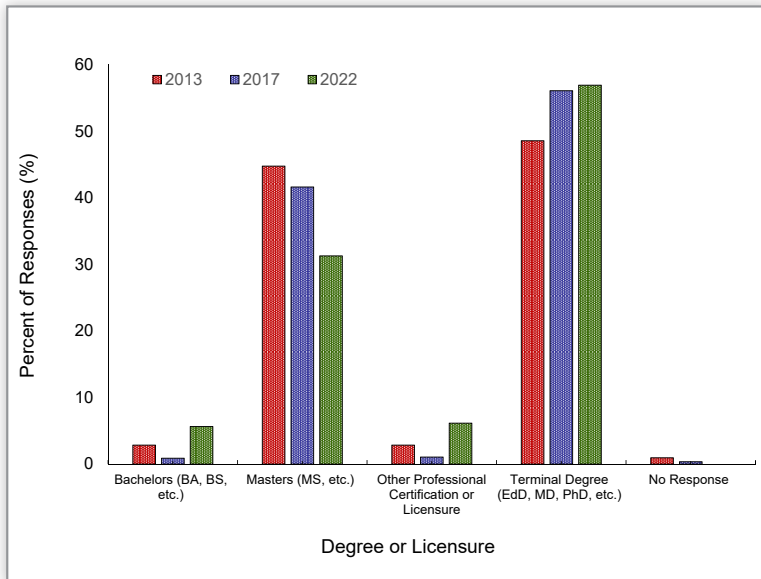


Figure 2. Highest degree and/or licenses held by respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply. Where applicable data from the 2013 and 2017 surveys were also included.

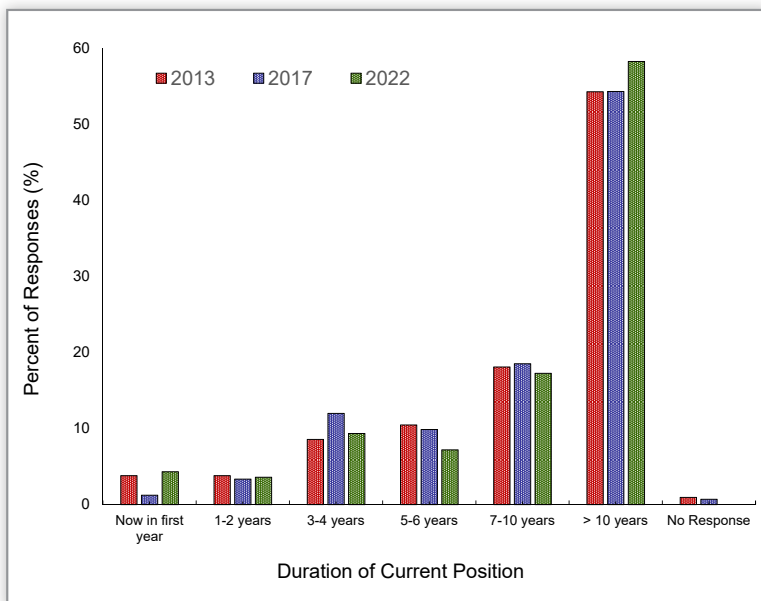


Figure 3. Duration of time spent in current position by respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Where applicable data from the 2013 and 2017 surveys were also included.

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Job responsibilities of respondents focused on teaching (98.9%) as well as multiple other commitments (Figure 4). More than 50% of respondents indicated that they also were responsible for service expectations, lab coordination, and/or course coordination. Approximately 20% of respondents indicated that their jobs also included research expectations or administrative duties. More than 90% of respondents were employed full-time (Figure 5). Most of the respondents to this question did not fully answer the question by also indicating if their contract had (n=44), or did not have (n=7), an expectation of renewal. When the question was answered completely, there were an equal number of responses for full versus part-time and renewable versus non-renewable.

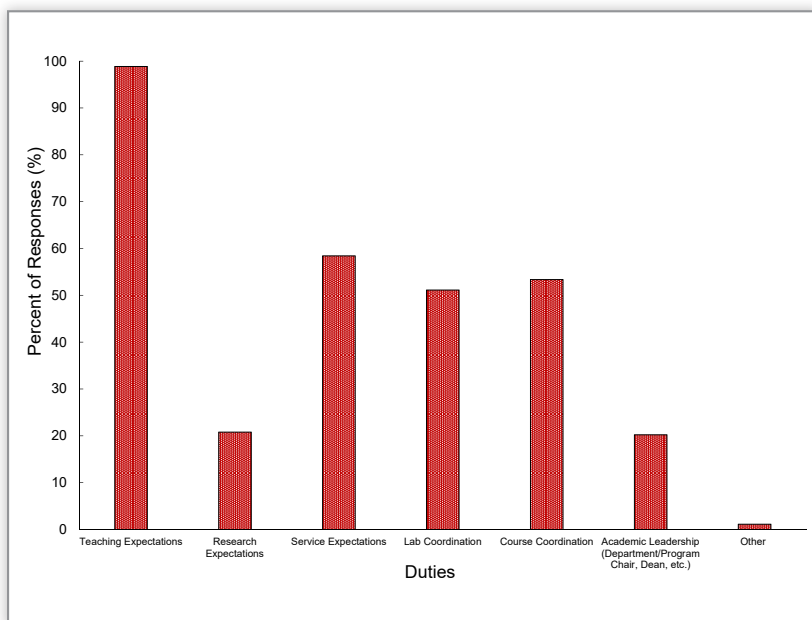


Figure 4. Job duties of respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply.

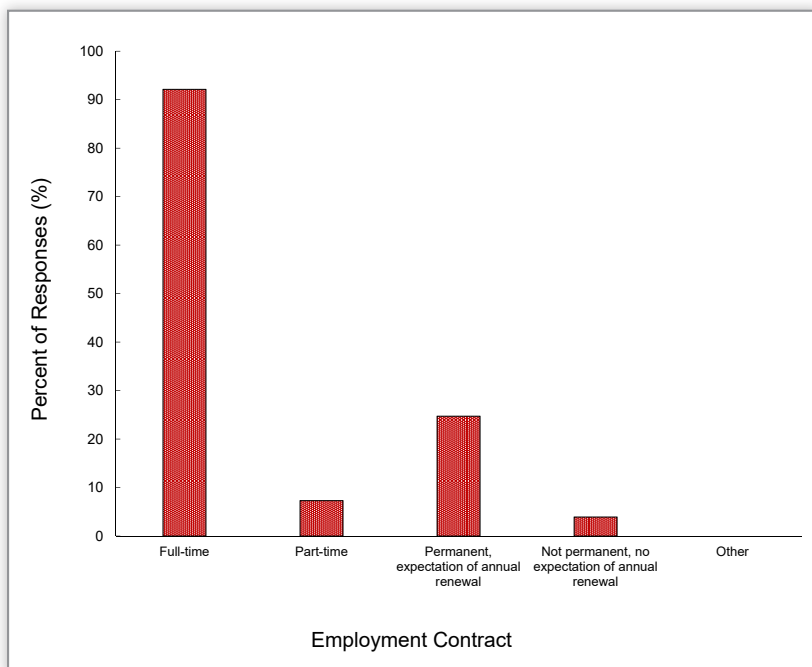


Figure 5. Position and contract characteristics of respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply.

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From the previous surveys to the current survey, there has been a decrease in the percentage of respondents working at 2-year institutions while the percentage at 4-year institutions increased (Figure 6). Of the 50% of current respondents working at 4-year institutions, slightly more than half were at institutions with a graduate degree program. Enrollment across all institutions from the current survey ranged from less than 1,000 students (11.9%), 1,000 to 5,000 students (38.1%), 5,000 to 15,000 students (27.3%), and more than 15,000 (22.7%). Enrollment in lecture and laboratory sections for A&P I and II, anatomy-only, physiology-only, and 1-semester A&P essentials courses for individual respondents and institutions varied extensively and reflected the diversity of institutions represented (Table 1).

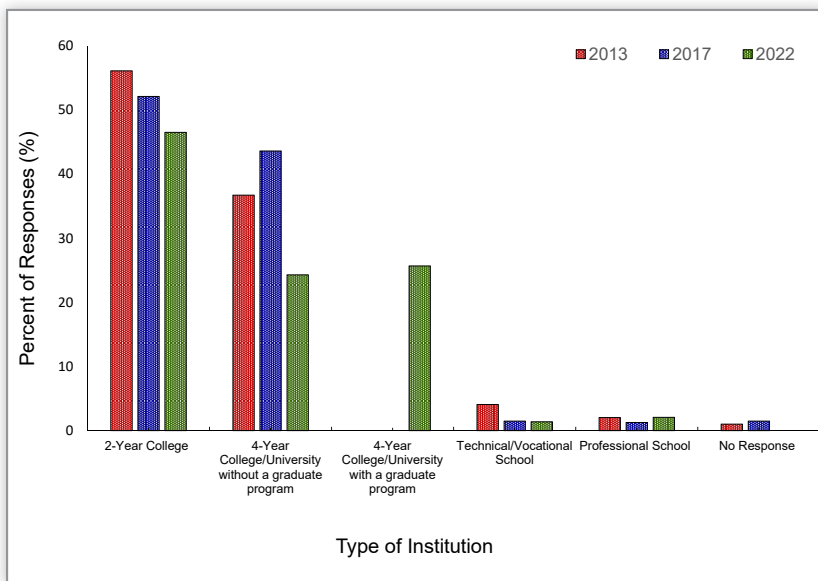


Figure 6. Type of institution employing survey respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents employed at more than 1 institution were directed to answer for their primary institution. Where applicable data from the 2013 and 2017 surveys were also included. In the 2013 and 2017 surveys 4-year institutions were not separated into those with a graduate program and those without a graduate program.

	Your average section size	Your number of sections	Your institution's number of sections
A&P I lecture	53.3	2.34	13.6
A&P I lab	32.6	2.68	16.5
A&P II lecture	52.1	2.23	9.42
A&P II lab	31.5	2.58	12.3
Anatomy lecture	93.3	1.93	6.22
Anatomy lab	28.7	3.43	10.5
Physiology lecture	64.3	1.36	3.66
Physiology lab	27.0	2.34	6.53
1 semester, A&P essentials lecture	25.7	0.88	10.2
1 semester, A&P essentials lab	18.9	0.80	16.9

Table 1. Average student enrollment, number of sections per respondent, and number of sections per respondent institution for anatomy and physiology lectures and labs. (n=176; HAPS 2022 Curriculum and Instruction lab survey)

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Combined lecture and laboratory courses with a single course number were the most common for respondents' institutions for A&P I and II, anatomy-only, and physiology-only courses (Figure 7). Less frequently, respondents indicated that lecture and laboratory portions of a course were numbered separately at their institutions, though concurrent enrollment was required. Less than 4% of respondents indicated that lecture and laboratory portions of a course were numbered separately and that there was no requirement for concurrent enrollment. Preparation to enter nursing continued, as compared to the previous surveys, to be the most common reason for students enrolling in A&P courses (Figure 8). Other fields indicated by respondents included kinesiology, allied health, professional adjacent, and professional school programs. Respondents were directed to select all options that apply, and all options except for "other" were selected by more than 60% of respondents from all three surveys.

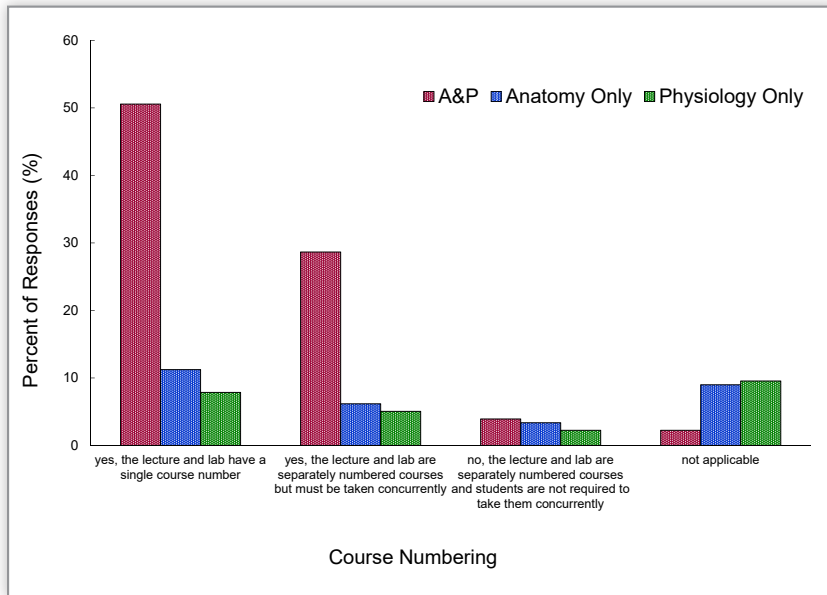


Figure 7. Course numbering and concurrent enrollment specifications for anatomy and physiology lecture and lab courses for respondents (n=176; HAPS 2022 Curriculum and Instruction survey) institutions.

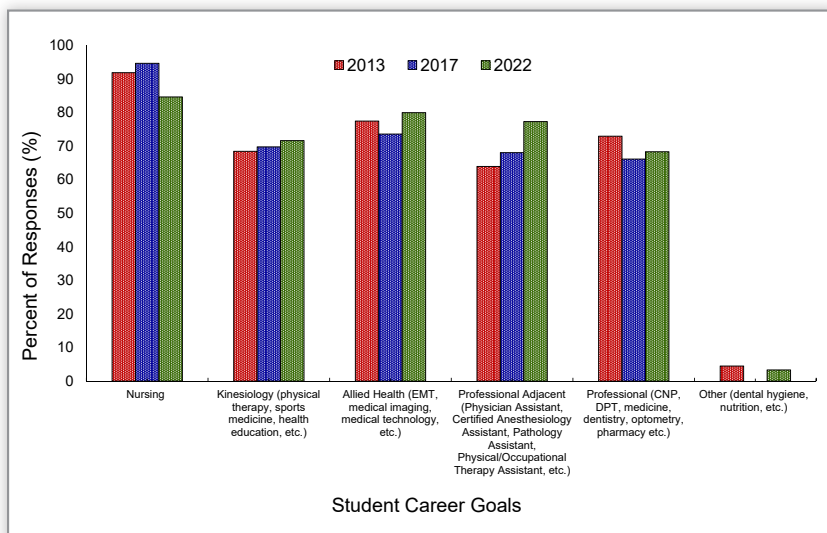


Figure 8. Career goals for students enrolled in the courses most often taught by survey respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply. Where applicable data from the 2013 and 2017 surveys were also included.

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Respondents were asked to indicate the format of their courses prior to the COVID-19 pandemic. This specification was highlighted in the survey in order to ask questions on pandemic-related changes in instruction in the third portion of the survey. In-person instruction was the most common format for both lecture (Figure 9a) and laboratory (Figure 9b) in A&P I and II, anatomy-only, physiology-only and 1-semester A&P essentials courses. Hybrid instruction was more common for lecture components of courses compared to the laboratories. The only course category where synchronous or asynchronous instruction was prevalent was in the “essentials” courses. Routine use of a HAPS Exam (Human Anatomy & Physiology Society, 2023b) by respondents was uncommon with 3.93% indicating use of the HAPS comprehensive A&P exam while 1.12% used the HAPS comprehensive anatomy only exam, 23.3% had considered using a HAPS exam but did not adopt one, and 65.7% did not use a HAPS exam. No respondent indicated routine use of the HAPS A&P I or A&P II exams.

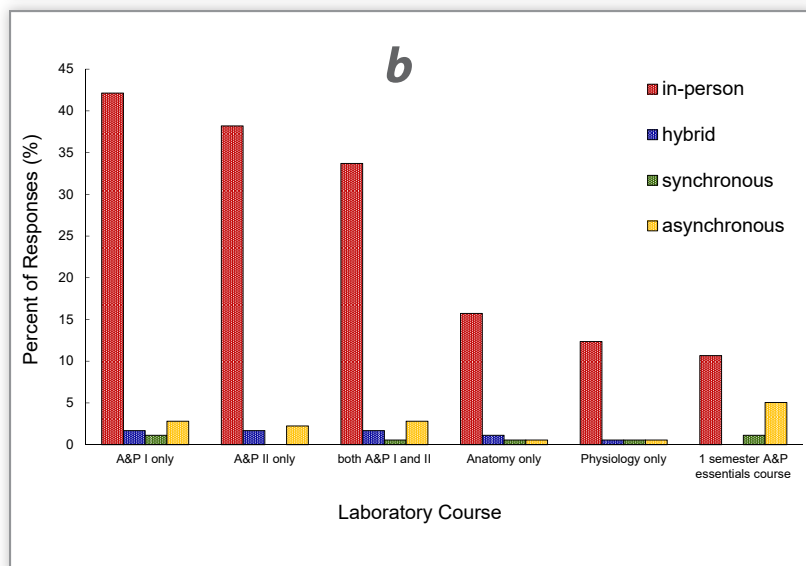
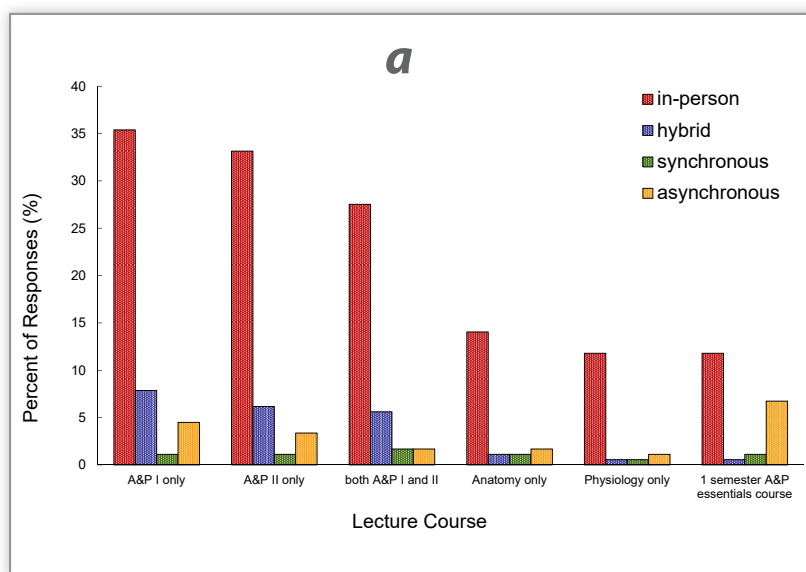


Figure 9. Course instruction formats (pre-COVID) for anatomy and physiology lectures (a) and labs (b) taught by respondents (n=176) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply.

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Sixty-six respondents indicated that their institutions charged lab fees for students enrolling in an A&P I, A&P II, anatomy-only, physiology-only, or a 1-semester A&P essentials course. The average lab fee charged was \$65.62 (USD) with a median charge of \$40 (USD). The minimum lab fee charged was \$5 (USD) with a maximum of \$450 (USD). Lab manuals and lecture textbooks were the most common course resources required by students (and not covered by lab fees) for 52.8% and 42.7% of respondents, respectively (Figure 10). Digital resources and personal lab equipment were less frequently required.

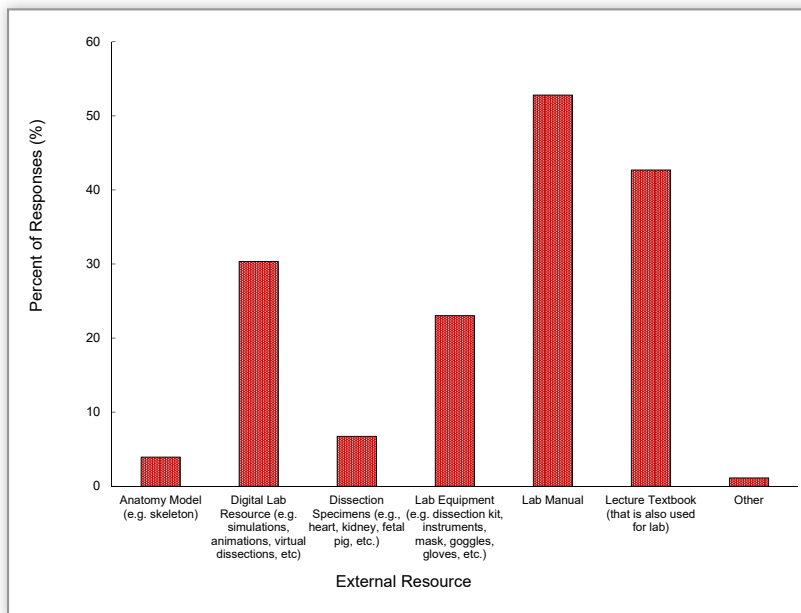


Figure 10. External resources (e.g., not covered by tuition or lab fees) required to be purchased or rented by students for lab activities taught by survey respondents ($n=176$) to the HAPS 2022 Curriculum and Instruction survey. Respondents were directed to select all answers that apply.

Discussion

In comparing the respondent demographics from our current survey with those of 2017 and 2013, there are clear trends that are discernible in addition to several noteworthy differences, both in the responses given and with certain questions included within the previous surveys (Brashinger, 2014a; 2014b; 2017). Although the number of participants was less than in 2017 ($n=567$), there was still a sizable increase of respondents in comparison to the initial survey of 2013 ($n=105$), and a relatively even geographical distribution.

A majority of respondents from all surveys indicated membership in HAPS and at least one other professional society; however, there has been a substantial decrease in American Physiology Society (APS) membership. Anecdotally, one of the subcommittee members (Schmitz) stated that the decrease in educational outreach opportunities by APS was their reason for APS membership non-renewal. The percentage of respondents having earned a terminal degree (e.g., Doctor of Education, PhD, or MD) continued to reveal an upward trend, mirrored by a diminishing number

of respondents with a master's and a considerably smaller percentage of those having a bachelor's or other professional certification as their highest degree or licensure.

Over half of survey participants had taught at their current institution for at least 10 years and nearly one-fifth of respondents had been at their institution for 7-10 years, with a modest increase in those with 10 plus years for the current survey. This is a consistent response across all surveys that signifies the considerable teaching experience of participants, the vast majority of whom (~90%) are presently working at a single institution and considered to be of full-time faculty status. Interestingly, previous surveys suggested that about 80% of respondents had permanent positions. If the question of position renewability had been completely answered on the current survey, there would have been equal numbers of renewable versus non-renewable responses. Future iterations of this question will be revised to clarify the information requested on both employment status (full versus part time) and contract type (renewable vs. non-renewable).

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Responses to a novel question in the 2022 survey regarding job responsibilities indicated that almost 99% of participants focus on teaching for their job duty, but over half also indicated the inclusion of other responsibilities such as service, lab and/or course coordination, academic leadership and research expectations. These results affirm the multiple roles that A&P instructors serve at their respective institutions, both inside and outside the classroom.

There have been several previously published surveys of A&P instruction in recent years (Hopp et al., 2019; Keiner et al., 2014) that revealed important characteristics of instructors; however, their overall respondent demographics were less comprehensive than the HAPS lab surveys of 2013, 2017 and 2022. A number of surveys have been conducted to investigate skeletal muscle coverage in undergraduate anatomy and A&P courses. The Saladin survey (2008) provided informative data on specific skeletal muscles covered in these classes, but without details for respondent demographics. A subsequent skeletal muscle survey by O'Loughlin et al. (2022) and Reynolds et al. (2022) did analyze characteristics of the courses and institutions of respondents, such as geographic location and the type of institution, but focused more on the course demographics and muscle coverage in human anatomy and A&P courses. This survey revealed that the vast majority of respondents taught at institutions within the United States, with 62% of them at a 4-year college or university. This contrasts with the results of each HAPS lab survey, which indicated that the largest single category of responses was from 2-year colleges, although the 2022 survey revealed that collectively 4-year colleges/universities with or without a graduate program comprised nearly one-half of all responses. Subsequent to the muscle survey, a similar study of skeletal system coverage has recently been developed by Aryal and O'Loughlin (2022). This survey will collect demographics on the course format and the type and geographic location of the respondent's institution, although the main focus of this survey pertains to the bones and bone features being taught in undergraduate A&P courses.

Like O'Loughlin and Reynold's muscle survey, a prior study by Hopp et al. (2019) that assessed aspects of teaching assistant use in A&P courses also indicated that the majority of participants were from the United States, most of whom were teaching at either a 2-year community college/technical school or a 4-year public, nonprofit institution. Additionally, Hsu and Halpin (2022) recently published a study exploring the coverage of core concepts by physiology instructors, revealing that a majority of instructors were at research-intensive (R1) or comprehensive (R2) universities, with approximately one-quarter of respondents teaching at small liberal arts or 2-year colleges. This physiology survey also indicated that nearly 60% of participants were full or associate professors, approximately 21% were assistant professors, and the remainder were lecturers, part-time faculty, or occupied other instructor positions. A significant

majority (84%) of respondents for this survey had 5 or more years of teaching experience, which corroborates the results from the HAPS 2022 lab survey that showed that a sizable majority of participants have taught at least 5 years at their current institution, attesting to the considerable teaching experience accrued for many of the respondents.

Relative to previous surveys (Brashiner 2014a; 2014b; 2017), the largest change seen in this survey relative to previous surveys was a greater percentage of respondents coming from 4-year institutions both with and without graduate programs. The type of institution employing respondents may influence their responsibilities as well as differences in curricular focus. Even though there has been movement away from stratification of education (difference in expectations of student performance and capability at the 2-year relative to the 4-year college), there is still implicit or overt bias by some towards goals, expectations, and quality of instruction for students at a 2-year versus a 4-year institute. Biases favoring instruction at 4-year institutions can be nullified through appropriate training and implementation of principles of curriculum development [e.g., course blueprinting and backwards design or integration of core concepts as guiding instruction (Coderre et al., 2009; Emory, 2014; Hull et al., 2017; Ismail et al., 2020; McLaughlin et al., 2005; Michael & McFarland, 2020; Patil et al., 2015; Villarroel et al., 2018)]. Yet, those who might have the greatest impact on this bias, tend to have a reduced ability to achieve training using newer fundamentals of educational theories (Hyson 2021).

Institution size varied considerably for our respondents with some of them teaching lectures to classes numbering in the hundreds of students. Within the laboratory, however, there was relative consistency in the class size (~30 students/section). An enrollment cap for laboratory instruction can be seen as a benefit to ensure proper supervision of students for safety purposes (Human Anatomy & Physiology Society, 2018), allow for maximum active participation in laboratory exercises and within groups, and allow for an optimal educational environment for laboratory and experimental based learning (Hofstein & Lunetta, 1982; McComas, 2005).

Prior to March of 2020 (the onset of COVID-19 pandemic modifications), the majority of instruction occurred in-person for both lectures and labs. Yet, there was a greater variety of instructional formats in the presentation of lecture materials relative to laboratory instruction. Responses showed an emphasis on in-person laboratory instruction and the importance of hands-on instruction, regardless of the course, and mirrored what has been previously reported on the topic (Henige, 2011; Hofstein & Lunetta, 1982; McComas, 2005). This emphasis may have led to difficulty in establishing meaningful laboratory instruction in the online environment, something that many experienced at the beginning of the pandemic modifications of 2020-2022 (Davis & Pinedo, 2021; Stokes & Silverthorn, 2021). There

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was less variety in the mode of instruction in anatomy-only and physiology-only courses, relative to A&P (both I and II), along with a higher reliance on the asynchronous mode of instruction in the 1-semester A&P essentials course when delivery of instruction was not in-person. To the latter point, the use of online instruction in the 1-semester course could serve as a model for institutions or instructors seeking to add permanent online courses in A&P, anatomy-only and/or physiology-only, especially given current trends in increased use of distance and online learning in higher education (Harmon et al., 2021; Rowe, 2017; Seaman et al., 2018; Stokes & Silverthorn, 2021).

The current study shows that the primary reason students enrolled in A&P courses continues to be an attraction to a career in nursing. This is in line with the recent findings of the American Association of Colleges of Nursing (2022) that indicated interest in a nursing career as one of the best correlates for student enrollment in these programs. Notably, our survey data also shows an increase in the enrollment of students interested in other kinds of healthcare careers (including allied health, professionally-adjacent, and kinesiology-based careers). This increase in interest may be due (at least in part) to the monetary benefits of any career in healthcare. The US Bureau of Labor Statistics (2022) estimates that the median annual income of healthcare professionals is, on average, \$29,280 higher than the median annual income of all other surveyed professions. This, coupled with the projected 13% growth in jobs in the healthcare industry, seems to indicate that demand for A&P courses will only continue to grow in the coming years.

According to Zippia's Database of over 30 million profiles (2022), there are roughly 6,446 A&P instructors employed in the United States. About 65% of these instructors are over 40 years old while only 13% are under 30. This disparity in demographics highlights a potential challenge in future A&P education: as trained faculty members reach retirement age, the need for newly qualified instructors will increase. In the United States, there are currently only 21 active anatomy doctoral programs, and in recent years, the number of graduates from these programs has declined (Wilson et al., 2021). As the need for well qualified instructors continues to grow, high quality anatomy and physiology-specific training programs may not be able to meet this demand. Many institutions already rely on faculty members directly trained in other fields to teach their A&P courses. Physicians, chiropractors, physical therapists, and biologists with varied backgrounds already instruct these courses in many colleges and universities, and this trend will likely only increase in the coming years. To offset some of this concern and assist institutions in making decisions on qualifications of any individual instructor to teach Anatomy and Physiology, HAPS has provided guidance that can be followed through the accreditation position statement of 2020 (Human Anatomy & Physiology Society, 2020).

Aside from adding new faculty or increasing course sizes, one other possible method of meeting enrollment demands could be an increase in the use of virtual courses. For better or for worse, the COVID-19 pandemic showed that A&P lab courses can be delivered virtually. Studies into the effectiveness of this modality have had mixed results. With regard to first-year medical students, Harrell et al. (2021) found that online students significantly outperformed those who had taken a traditional onsite human anatomical donor-based anatomy lab and posit that their results may be due to increased use of narrated dissection videos, video conferencing, and lab practicums using video clips from multiple perspectives. However, Colthorpe and Ainscough's 2021 analysis of undergraduate student performance in a virtual physiology lab showed significant declines in performance compared to traditional onsite students. Almost half of the virtual undergraduate students in that study indicated that the lack of live sessions hindered their academic progress, although structured learning progressions (including materials that were arranged topically) were very helpful. Feedback about what is and is not effective in the virtual learning environment will be critical to finding ways to use this modality to meet course enrollment demands. Additional insights on teaching A&P during the pandemic will be discussed in the third manuscript to come from the 2022 survey.

Education has always been seen as an opportunity to breach the equality barriers of society, as it offers individuals an opportunity to gain skills and education that can propel their careers and increase their earning power regardless of their prior socioeconomic status. Yet, according to the US Department of Education, "Tuition increases are outpacing the rate of inflation, increases in family income and increases in financial aid" (Boehner & McKeon, 2003). Rising costs, socio-economic status, or first-generation college-student status, can by themselves, or potentially combine with lab and/or course fees, to raise the equality barrier.

The lab is an essential component of A&P curricula and is integral to the understanding of course content. The lab activities provide students with opportunities for hands-on learning, while promoting constructivist approaches to education and inquiry-based learning which strengthens analytical reasoning, critical thinking, and problem-solving skills. College institutions requiring extra lab fees for participation in science courses to offset expensive equipment and educational tools needed for the lab activities should review their practices to see if such fees may bar some students from successful completion of their curriculum. Institutions should be encouraged to re-evaluate and determine whether these added fees are essential to maintain the quality of lab instruction being offered. While this survey did not identify the resources funded by lab fees, such information is needed for institutional re-evaluation as well as future versions of this survey.

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Conclusions

With each iteration of the HAPS lab survey, the breadth and depth of the data obtained have increased. These improvements result from refinements in question presentation and clarification of data needed. Alternatively, the data obtained are negatively impacted when terminology (e.g., employment status) is not consistent across institutions and survey research instruments. Alleviating this impact will require careful question phrasing as well as regular, systematic collection of demographic data by professional societies (e.g., during membership renewal) and researchers.

The third offering of the HAPS Curriculum & Instruction lab survey was delayed by COVID-19 pandemic, but the delay also created the opportunity to characterize instructional practices across a diversity of courses, institutions, and instructors prior to, during, and after the main disruption in 2020 and 2021. These demographic variables are used as comparison factors for analysis and interpretation of data for Part II (lab activities and HAPS learning outcomes/goals) and Part III (impact of a global pandemic on A&P teaching and science instruction in higher education). Parts II and III will be presented in upcoming issues of the *HAPS Educator*.

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About the Authors

Carol A. Britson, PhD, is an instructional professor and Associate Chair for Undergraduate Studies in the Department of Biology at the University of Mississippi. She teaches human anatomy, histology, physiology, comparative embryology, and human A&P I and II. She also serves as the Secretary (2021- 2025) for the Human Anatomy and Physiology Society (HAPS). James Clark, PhD, is an assistant professor in the Department of Biology at Los Medanos College. He teaches A&P I and II and essentials of human A&P. Chinenye Anako, MD, MPH, is a clinical instructor and coordinator at Georgian Court University. She teaches A&P I and II as well as medical A&P I. Rachel Hopp, PhD, is an associate professor in the Biology Department at the University of Louisville. She teaches human A&P I and II, cancer biology, freshman biology for nonmajors, and freshman biology for majors. She is the past Chair of the Curriculum & Instruction Committee HAPS. Heather A. Armbruster, MS, is an instructor in biology at Southern Union State Community College, Alabama.

She teaches Human A&P 1 and 2. Chris E. Kule, PhD, is an assistant professor of biology at the Pennsylvania College of Technology. He teaches Human A&P I & II and biochemistry.

Julia M. Schmitz, PhD, is an associate professor in the Biology Department at Piedmont University. She teaches Human A&P I and II, medical microbiology, microbiology, and general biology. Jeff Huffman, MS, is an instructor at Salt Lake Community College. Marnie Chapman, MS, MA, is a professor of biology at the University of Alaska Southeast, Sitka Campus. She teaches Human A&P I and II, microbiology, One Health perspectives, and marine mammals of Alaska. Cynthia Schmaeman, MS, is a lab coordinator for biology and environmental science at Auburn University, Montgomery. Janay Dennis, MS, is an instructor at Mitchell Community College. Kathleen Ahles, PhD, is an associate professor of instruction in the Department of Biology at the University of University of Texas – Arlington. She teaches Human A&P I and II, microbiology, and general biology.

Literature Cited

- American Association of Colleges of Nursing. (2022, April 5). *Nursing schools see enrollment increases in entry level programs, signaling strong interest in nursing careers*. <https://www.aacnnursing.org/news-data/all-news/article/nursing-schools-see-enrollment-increases-in-entry-level-programs>
- Aryal, A. & O'Loughlin, V. D. (2022). "What bones and bony features are you teaching your students?" A survey of skeletal system coverage in undergraduate human anatomy and physiology courses. *FASEB Journal* 36(S1). <https://doi.org/10.1096/fasebj.2022.36.S1.R3025>
- Boehner, J.A. & McKeon H.P. (2003). The college cost crisis: A congressional analysis of college costs and implications for America's higher education system. <https://eric.ed.gov/?id=ED479752>
- Brashinger, D. P. (2014a, March 15). *The HAPS laboratory instructor survey: A discussion of the preliminary data* [Conference presentation abstract]. HAPS Eastern Regional Meeting, Springfield, MA, United States. <https://cdn.ymaws.com/www.hapsweb.org/resource/resmgr/Conference/2014EasternRegProgram.pdf>
- Brashinger, D. P. (2014b, May 24-29). *The HAPS laboratory instructor survey: Final results and implications for instruction* [Conference presentation abstract]. Twenty-eighth Annual Conference of the Human Anatomy and Physiology Society, Fort Lauderdale, FL, United States. https://cdn.ymaws.com/www.hapsweb.org/resource/resmgr/Conference/HAPS-2014_Conference_Program.pdf

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- Brashinger, D. P. (2017). Instructional goals and practices in the introductory undergraduate pre-health professions anatomy and physiology laboratory. *HAPS Educator Special Edition*, 4-23. <https://doi.org/10.21692/haps.2017.001>
- Britson, C. A. (2022, February 14). HAPS lab survey 2022. *The HAPS Blog*. <https://hapsblog.org/2022/02/14/haps-lab-survey-2022/>
- Britson, C. A., Hopp, R., Clark, J., Armbruster, H., Kule, C., Anako, C. et al. (2022, May 25-29). *HAPS 2022 Lab Survey* [Conference presentation abstract. Thirty-sixth Annual Conference of the Human Anatomy and Physiology Society, Fort Lauderdale, FL, United States. <https://cdn.ymaws.com/www.hapsweb.org/resource/resmgr/haps2022/haps-2022-fl-program-c.inddr.pdf>
- Coderre, S., Woloschuk, W., & McLaughlin, K. (2009). Twelve tips for blueprinting. *Medical Teacher*, 31(4), 322-324. <https://doi.org/10.1080/01421590802225770>
- Colthorpe, K. & Ainscough, L. (2021). Do-it-yourself physiology labs: Can hands-on laboratory classes be effectively replicated online? *Advances in Physiology Education*, 45(1), 95-102. <https://doi.org/10.1152/advan.00205.2020>
- Davis, C. P. & Pinedo, T. (2021). The challenges of teaching anatomy and physiology laboratory online in the time of COVID-19. *Journal of Microbiology & Biology Education*, 22(1), 1-4. <https://doi.org/10.1128/jmbe.v22i1.2605>
- Emory, J. (2014). Understanding backward design to strengthen curricular models. *Nurse Educator*, 39(3), 122-125. <https://doi.org/10.1097/nne.0000000000000034>
- Harmon, D. J., Attardi, S.M., Barremkala, M., Bentley, D.C., Brown, K.M., Dennis, J.F. et al. (2021). An analysis of anatomy education before and during Covid-19: May–August 2020. *Anatomical Sciences Education*, 14(2), 132–147. <https://doi.org/10.1002/ase.2051>
- Harrell, K. M., McGinn, M. J., Edwards, C. D., Warren Foster K., Meredith M. A. (2021). Crashing from cadaver to computer: Covid-driven crisis-mode pedagogy spawns active online substitute for teaching gross anatomy. *Anatomical Sciences Education*, 14(5), 536-551. <https://doi.org/10.1002/ase.2121>
- Henige, K. (2011). Undergraduate student attitudes and perceptions towards low- and high-level inquiry exercise physiology teaching laboratory experiences. *Advances in Physiology Education* 35(2), 197–205. <https://doi.org/10.1152/advan.00086.2010>
- Hofstein, A., & Lunetta, V. N. (1982). The role of the laboratory in science teaching: Neglected aspects of research. *Review of Educational Research*, 52(2), 201-217. <https://doi.org/10.2307/1170311>
- Hopp, R., Britson, C., Mukhopadhyay, S., Goldina, A., Chapman, M., & Nielsen, M. (2019). Teaching assistants in human anatomy and physiology: Their prevalence, recruitment strategies, funding, retention, and training. *HAPS Educator*, 23(2), 367-384. <https://doi.org/10.21692/haps.2019.015>
- Hsu, J. L. & Halpin, P. A. (2022). Exploring physiology instructors' use of core concepts: Pedagogical factors that influence choice of course topics. *Advances in Physiology Education*, 46(4), 667-676. <https://doi.org/10.1152/advan.00114.2022>
- Hull, K., Jensen, M., Gerrits, R., & Ross, K. T. (2017). Core concepts for anatomy and physiology: A paradigm shift in course and curriculum design. *HAPS Educator*, 21(2), 73-79. <https://doi.org/10.21692/haps.2017.017>
- Human Anatomy & Physiology Society. (2018). *Spotlight on safety*. https://www.hapsweb.org/page/Safety_home
- Human Anatomy & Physiology Society. (2020). *Accreditation Position Statement*. https://www.hapsweb.org/page/Accreditation_2020
- Human Anatomy & Physiology Society. (2023a). *HAPS regions*. <https://www.hapsweb.org/page/MapofHAPSRegions>
- Human Anatomy & Physiology Society. (2023b). *A&P I and A&P II exams*. <https://www.hapsweb.org/page/AP1and2Exam>
- Hyson, A. R., Bonham, B., Hood, S., Deutschman, M. C., Seithers, L. C., Hull, K., & Jensen, M. (2021). Professional development, shifting perspectives, and instructional change among community college anatomy and physiology instructors. *CBE Life Sciences Education*, 20(3), ar49,1-ar49,13. <https://doi.org/10.1187/cbe.21-02-0037>
- Ismail, M. A-A., Mat Pa M. N., Mohammad, J. A-M., Yusoff M. S. B. (2020). Seven steps to construct an assessment blueprint: A practical guide. *Education in Medicine Journal*, 12(1), 71–80. <https://doi.org/10.21315/eimj2020.12.1.8>
- Keiner, Y. C., McMahon, K., Schmidt, N., Jones, W. K., Olubadewo, J., Stout, S. et al. (2014). Accidents and injuries in the human A&P laboratory: A survey by the HAPS safety committee. *HAPS Educator*, 18 (Summer), 26-28.
- McComas, W. (2005). Laboratory instruction in the service of science teaching and learning: reinventing and reinvigorating the laboratory experience. *The Science Teacher*, 72(7), 24-29.
- McLaughlin, K., Coderre, S., Woloschuk, W., Lim, T., Muruve, D., & Mandin, H. (2005). The influence of objectives, learning experiences and examination blueprint on medical students' exam preparation. *BMC Medical Education*, 5, Article e39. <https://doi.org/10.1186/1472-6920-5-39>

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- Michael, J. & McFarland, J. (2020). Another look at the core concepts of physiology: revisions and resources. *Advances in Physiology Education*, 44(4), 752–762. <https://doi.org/10.1152/advan.00114.2020>
- O'Loughlin, V. D., Reynolds, A. M., Goodwin, M. E. (2022). Skeletal muscle coverage in undergraduate courses: A comparison of stand-alone human anatomy and anatomy and physiology (A&P) courses. *Advances in Physiology Education*, 46(3), 400–415. <https://doi.org/10.1152/advan.00038.2022>
- Patil, S. Y., Gosavi, M., Bannur, H. B., & Ratnakar, A. (2015). Blueprinting in assessment: A tool to increase the validity of undergraduate written examinations in pathology. *International Journal of Applied Basic Medical Research*, 5(Suppl 1), S76–S79. <https://doi.org/10.4103/2229-516x.162286>
- Reynolds, A. M., Goodwin, M. E., O'Loughlin, V. D. (2022). General trends in skeletal muscle coverage in undergraduate human anatomy and anatomy & physiology courses. *Advances in Physiology Education*, 46(2), 309–318. <https://doi.org/10.1152/advan.00084.2021>
- Rowe, R. J, Koban, L., Davidoff, A. J., & Thompson, K. H. (2017). Efficacy of online laboratory science courses. *Journal of Formative Design in Learning*, 2, 56–67. <https://doi.org/10.1007/s41686-017-0014-0>
- Saladin, K. S. (2008). How many muscles do you teach? A survey of HAPS-L readers. *HAPS Educator*, 13 (Fall), 10–13.
- Seaman, J. E., Allen, I.E., & Seaman, J. (2018). Grade increase: Tracking distance education in the United States. Babson Survey Research Group, Released under a Creative Commons Attribution-ShareAlike 4.0 International license. <http://www.onlinelearningsurvey.com/highered.html>
- Stokes, J. A., & Silverthorn, D. U. (2021). Updating anatomy and physiology lab delivery: Shifting from a paper-based to an online lab instruction platform, just in time for a global pandemic. *Advances in Physiology Education*, 45(2), 290–298. <https://doi.org/10.1152/advan.00190.2020>
- US Bureau of Labor Statistics. 2022. Healthcare occupations. In U.S. Bureau of Labor Statistics (Eds.), *Occupational outlook handbook*. <https://www.bls.gov/ooh/healthcare/home.htm>
- Villarroel, V., Bloxham, S., Bruna, D., Bruna, C., Herrera-Seda, C. (2018). Authentic assessment: creating a blueprint for course design. *Assessment & Evaluation in Higher Education*, 43(5), 840–854. <https://doi.org/10.1080/02602938.2017.1412396>
- Wilson, A. B., Kaza, N., Singpurwalla, D.J., & Brooks, W. S. (2021). Are anatomy PhDs nearing extinction or adapting to change? United States graduate education trends in the anatomical sciences. *Anatomical Sciences Education*, 14(4), 432–439. <https://doi.org/10.1002/ase.2013>
- Zippia The Career Expert. (2022). Anatomy professor demographics and statistics in the US. <https://www.zippia.com/anatomy-and-physiology-instructor-jobs/demographics/>

