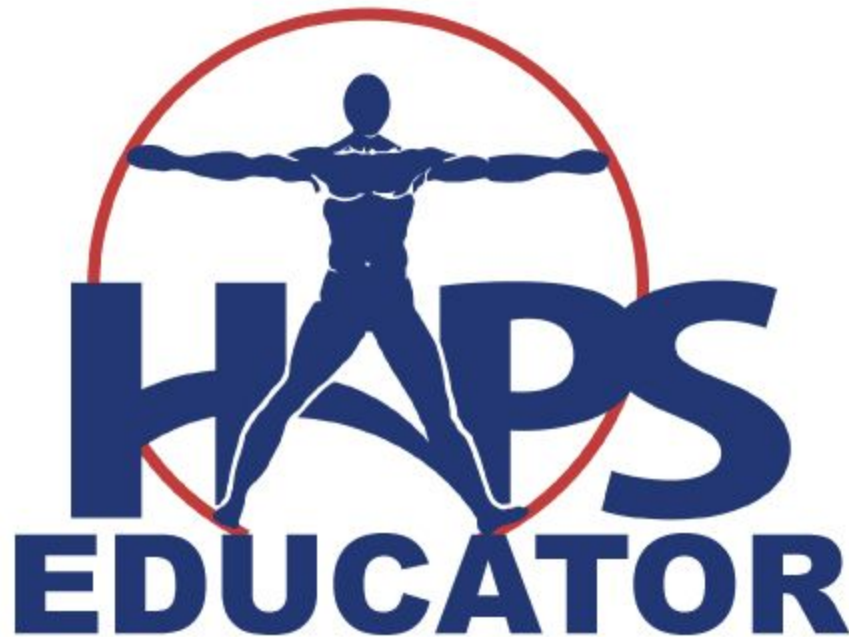


**Yoga Anatomy Workshops: Yoga as Experiential Learning in Undergraduate Anatomy Courses**

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# Yoga Anatomy Workshops: Yoga as Experiential Learning in Undergraduate Anatomy Courses

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## Abstract

Integrating lecture and laboratory material from a human anatomy course can be difficult for undergraduate students. This study sought to examine the effectiveness of yoga poses as experiential learning techniques for the musculoskeletal system. Yoga Anatomy (YA) workshop instructors discussed muscle names, locations, and functions as they applied to specific yoga poses using a PowerPoint presentation and posture demonstrations. Students then actively participated in each yoga pose as instructors reinforced the anatomy. YA participants not only scored higher on both pre- and post-tests than non-participants, they also showed positive trends in knowledge gain from pre-test to post-test. Although several factors, including a self-selection bias, may have influenced the study, the results suggest that yoga may be an effective form of experiential learning for human anatomy students. doi: 10.21692/haps.2017.056

**Key Words:** gross anatomy education, experiential learning, musculoskeletal anatomy, kinesthetic learning, yoga

*The information contained in this article will enhance student comprehension of human anatomy and their appreciation for active learning and discovery learning associated with the pedagogy of courses in Human Anatomy, in-depth anatomy, and Human Anatomy and Physiology courses.*

## Introduction

To aid in the blending of lecture and laboratory concepts such as function and structure, some instructors have become increasingly interested in the effects of incorporating experiential learning techniques into human anatomy curricula.

**Experiential learning** is a theory pioneered by notable 20<sup>th</sup>-century scholars, such as Jean Piaget, Carl Jung, and John Dewey, who argued that deep learning requires more than the strict memorization and repetition of facts (Kolb and Kolb 2005). To move beyond a superficial knowledge of facts, students must be engaged in relevant practical applications where personal experiences are expanded upon, more detail is added, and feedback is received. Experiential learning advocates the deepening of knowledge through a combination of “feeling and thinking” or “perception and cognition” (Janssen *et al.* 2014, Kolb and Kolb 2005, Nicholson *et al.* 2016). One goal of this holistic approach is to increase students’ ability to relate previously learned and perceived information to new experiences and situations. As many human anatomy students are considering careers in the medical and allied health care fields, skillfully integrating and applying structural and functional information is critical.

Kinesthetic learning is one of the sensation-based instructional methods categorized in Neil Fleming’s VARK model (Fleming 1995). The VARK model outlines four major learning modality preferences: Visual, Aural, Reading, and Kinesthetic. In general, those students who identify as kinesthetic learners prefer to learn through hands-on activities such as touching, holding, and creating. These students have often been described as “doers” who cement concepts by exploring examples and

representations tactilely (Lujan and Dicarilo 2005). Kinesthetic learning is similar to experiential learning in that both modalities emphasize the physical nature of “learning by doing.” The major difference between these learning preferences lies in the personal nature of experiential learning. Experiential learning in the anatomy classroom, for example, can deepen knowledge learned kinesthetically by helping students to understand the anatomy as it applies to their own bodies. Although Fleming’s VARK model and the hypothesis of learning preferences have been widely disputed (Willingham *et al.* 2015), learning modalities such as experiential learning have remained topics of interest.

As more educators explore the effects and potential benefits of experiential learning, some instructors have begun introducing innovative teaching techniques that are both kinesthetic and experiential. In a study conducted at the University of Western Australia, body paint was used to help students visualize muscles as they relate to their own skeletal structure. Students found the mind-body connection between concepts learned in lecture and the kinesthetic process of painting to be a useful learning tool as well as an enjoyable activity (McMenamin 2008). The University of Sydney hosted a multi-modal anatomy workshop for undergraduate anatomy students that also utilized body painting, as well as clay modeling and white-board drawing, to review musculoskeletal anatomy. Investigators compared scores from all students’ mid-semester examinations and end-semester examinations with results indicating that workshop attendees significantly improved their examination scores (Nicholson *et al.* 2016).

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The concept of using yoga postures and sequences to teach anatomy was brought to Mount Sinai School of Medicine in the form of a Living AnatoMe program (McCulloch *et al.* 2010). This program offered to first-year medical students, employed yoga and Pilates movements in the review of musculoskeletal anatomy previously discussed in gross anatomy lectures and laboratories. Instructors guided students into specific postures and exercises, allowing for muscle movements to be experienced while discussing the anatomy. Pre- and post-test scores showed significant improvement in total Living AnatoMe scores, indicating that the incorporation of learned and experienced information can enhance students' overall knowledge of the material (McCulloch *et al.* 2010).

A similar study conducted by Queen's University in Kingston, Ontario, Canada examined the effects of repeated physical experiences on learners' ability to conceptualize the anatomy of multiple body systems. The study used several visual resources including PowerPoint presentations, worksheets, limb models, and prosected cadavers to first teach skeletal anatomy to non-student community members with at least some yoga experience (Bentley and Pang 2012). After the skeletal anatomy portion, participants were directed into five elementary yoga poses using only skeletal anatomy cues. Participants remained in each posture as the anatomy was reinforced. Next, participants learned muscular anatomy and were redirected into the same five yoga poses, this time using only muscular cues. Results of session feedback suggest that building upon repeated experiences by adding more detail each time can expand learner understanding of a particular concept.

While these studies have highlighted the effects of experiential learning on knowledge gain (suggested improvement from pre- to post-tests or in exam scores), few studies to date have

quantified how experiential learning can influence both knowledge gain *and* depth (depth referring to the application of anatomical concepts to practical or clinical scenarios). In an attempt to investigate the potential benefits of experiential learning on anatomy students' knowledge application skills, a Yoga Anatomy (YA) workshop was developed at Indiana University in Bloomington, Indiana by the authors. This study explores the use of yoga poses and posture sequences to review basic musculoskeletal anatomy and develop the ability to relate learned concepts and personal experiences to real-life situations.

## Methods

### The Course

All participants of this research study were undergraduate students enrolled in Indiana University-Bloomington's Basic Human Anatomy (A215) course for the Spring 2016 semester. The course is divided into a lecture (enrollment of approximately 400 students) and laboratory portion with an average of 35-38 students in each laboratory section (for a total of 12 lab sections). There is no pre-requisite for A215, though student enrollment consists primarily of pre-allied health profession majors (e.g., public health, pre-nursing, pre-physical therapy, athletic training) for whom A215 is a required course. Other programs such as dietetics, exercise science, and dance also require students to complete A215 as part of their curriculum, and students from those disciplines comprise a significant portion of the demographic as well. Most students are freshman and sophomores; however, several juniors and seniors enroll in the course each semester along with a small number of students who are retaking the course. Additional student demographic information gathered by the course instructor for the Spring 2016 enrollment of A215 is listed in Table 1.

Table 1.  
Demographic information for Spring 2016 enrollment of A215 - Basic Human Anatomy

Academic Program	Number of Students	Ethnicity	Number of Students	Gender	Number of Students	Full-Time/Part-Time	Number of Students	Age (mean $\pm$ SD)
Arts and Sciences	146	Asian	1	Male	109	Full-Time	461	19.7 $\pm$ 1.6
Business	2	Black/African American	2	Female	356	Part-Time	4	
Education	1	Hispanic Latino	1					
Informatics	1	None Selected	2					
Liberal Studies	2	Two or More Races	1					
Music	1	White	2					
Pre-Nursing	123							
Public Health	183							
Undeclared	6							

Student demographic information as collected by the course instructor. Total course enrollment for the Spring 2016 semester was 465 undergraduate students.

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Students meet three times weekly for the 50-minute lecture component and twice weekly for the one hour and 45-minute laboratory. Two graduate student teaching assistants (TAs) and one undergraduate teaching assistant (UTA) teach the laboratory portion of A215. Each laboratory consists of a brief (15-20 minute) PowerPoint presentation, created by the Laboratory Coordinator and delivered by the instructors, followed by self-directed study time for the remainder of the class period. Within the laboratory space, students have access to anatomical models, virtual microscopes, and prosected cadavers. Students do not have access to these materials outside of class time except for one-hour open labs offered on certain Fridays and a two-hour review session the weekend before each exam.

## Recruitment

This project was approved by the Institutional Review Board of Indiana University (# 1506092395), and informed consent was obtained from all participants.

Yoga Anatomy workshop participants were recruited through in-class announcements, emails, and flyers to attend one of two identical sessions reviewing musculoskeletal anatomy. The YA workshops were scheduled two days apart, the week before the musculoskeletal lecture and lab exams. This scheduling gave students as much time as possible to study lecture and lab material before the YA workshops and control tests while adding to the appeal of the workshops as a “last chance” to study. Approximately two weeks before the workshops were held, the authors personally announced the details and purpose of the YA workshops to A215 students before one of their lectures. Scripts of the YA workshop announcements were then sent to all TAs and UTAs to read aloud at each laboratory session. The authors also emailed YA workshop announcements to the entire A215 roster and posted flyers advertising the YA workshop by the lecture and laboratory classrooms. All forms of recruitment emphasized that yoga experience was not necessary to participate in the YA workshops and that participation was completely voluntary and inconsequential to A215 grades. Should they wish to participate, students were instructed to email the authors of this manuscript to register for the YA workshop.

## Participants

The treatment group consisted of 33 Yoga Anatomy workshop participants. As outlined in all recruitment materials, current enrollment in A215 was required for participation in the study. Most YA workshop participants were female and the majority of YA students were freshman and sophomores between the ages of 18 and 25 – similar to the demographic composition of the entire A215 class.

The control group was recruited after the completion of both YA workshop sessions. The authors made in-class announcements to several laboratory sections regarding participation in the research study as a control. Students who

qualified to participate as a control were currently enrolled in A215 and had not attended any of the YA workshop sessions. Pre- and post-tests were given to the control group during their usual A215 lab time only one day after the last YA workshop.

To ensure anonymity, the authors distributed sets of study information sheets and pre-tests (the same pre-tests given to YA participants, which are described in detail in the next section) to all qualifying students. The students were told that they may submit their pre-test completed if they wished to participate in the study or return the blank pre-test if they did not wish to participate. Control participants were then given one hour of independent study time (equivalent to the YA students’ one hour of workshop study time) to review musculoskeletal anatomy with access to plastic models and prosected cadavers. After one hour, the authors distributed post-tests (identical to YA post-tests, described in the next section) to all students who had not attended a YA workshop. Students who filled out a pre- and/or post-test created their own identification number to keep their scores anonymous but allow instructors to track their progress from test to test.

In an attempt to keep the control group size similar to that of the treatment group, a random sample of 33 participating control students who completed both a pre-test and a post-test were selected as the control group for this study. Demographic data from the control group was not recorded.

## Materials

Pre- and post-tests were used to examine students’ performance on lecture-style questions. Each test consisted of ten multiple-choice questions, many of which required practical application of anatomical knowledge, that referenced concepts previously learned in course lectures (question examples may be found in Figure 1). To avoid the practice effect – students improving due to familiarity with the assessment (Mulligan NW and Peterson DJ 2015) – separate but similar questions were used for the pre- and post-test. Prior to the Yoga Anatomy workshops, the authors created a total of 25 multiple-choice questions that tested muscle names, locations, and functions. These questions were written in a format similar to the wording of A215 lecture examinations and covered topics that all A215 students had been taught.

Authors then conducted a pilot study to determine the difficulty level of each question. The purpose of this session was to ensure that, while the pre- and post-tests were not identical, the tests contained the same amount of higher and lower order questions according to the Blooming Anatomy Tool (Thompson and O’Loughlin 2014) and that there would be no significant difference in difficulty between the two tests. A panel of human anatomy instructors – three graduate students and one faculty member – participated in the norming session. Questions were rated on a scale of one to

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four. Questions scoring as one or two were considered a “lower order” Bloom question, while anatomy questions scoring three or four were considered “higher order” on the Bloom taxonomy, per the Blooming Anatomy Tool (Thompson and O’Loughlin 2014). Cronbach’s Alpha was used to determine the inter-rater reliability and the five questions with the lowest alpha coefficient (i.e., the five questions with the most disparity amongst raters) were discarded. For the remaining

20 questions, the authors of this study used the mode of each question to determine its level of difficulty. The ratings of the final 20 questions are outlined in Table 2. Questions were then grouped according to the level of difficulty and evenly distributed between the pre- and post-test, ensuring that each test received the same amount of lower order (level one and two) and higher order (level three and four) questions.

Table 2.  
BAT ratings for multiple choice questions

Question	Rater 1	Rater 2	Rater 3	Rater 4	Mode	Test
1	1	1	1	1	1	Pre
2	2	2	2	2	2	Pre
3	4	3	4	1	4	Pre
4	1	2	2	2	2	Pre
5	2	1	1	1	1	Pre
6	2	1	2	2	2	Pre
7	3	2	3	1	3	Pre
8	4	2	2	2	2	Pre
9	2	2	2	3	2	Pre
10	4	3	3	3	3	Pre
11	4	3	4	2	4	Post
12	2	1	2	2	2	Post
13	1	2	2	2	2	Post
14	2	2	3	4	2	Post
15	2	2	3	2	2	Post
16	3	3	4	3	3	Post
17	3	3	4	1	3	Post
18	2	1	3	2	2	Post
19	3	2	1	1	1	Post
20	1	2	3	1	1	Post

Level of question difficulty was measured on a scale of 1-4 according to the Blooming Anatomy Tool (BAT). Pre- and post-tests both contained: one Level 4, two Level 3, five Level 2, and two Level 1 questions.

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Figure 1.

Test-question Examples

## Yoga Anatomy Musculoskeletal Workshop Pre-Test

**8 DIGIT CODE** (four-digit birth year + last 4 digits of phone number): \_\_\_\_\_

- 1.) Why was rectus femoris named in such a way?
  - a.) It is a multi-headed muscle located in the thigh
  - b.) It is a pennate muscle located in the thigh
  - c.) It is a straight muscle located in the thigh
  - d.) It is a triangular muscle at the thigh
- 2.) Which of the following statements is **true**?
  - a.) Biceps brachii extends the arm
  - b.) Brachioradialis flexes the forearm
  - c.) Triceps brachii adducts the arm
  - d.) Flexor digitorum superficialis supinates the forearm

- 3.) Which of the following pairs of actions correctly describes this exercise moving from A to B:
  - a.) Biceps femoris is extending the thigh AND soleus is extending the leg
  - b.) Vastus lateralis is extending the thigh AND gastrocnemius is flexing the leg
  - c.) Sartorius is flexing the thigh AND tibialis posterior is extending the leg
  - d.) Rectus femoris is flexing the thigh AND gastrocnemius is flexing the leg

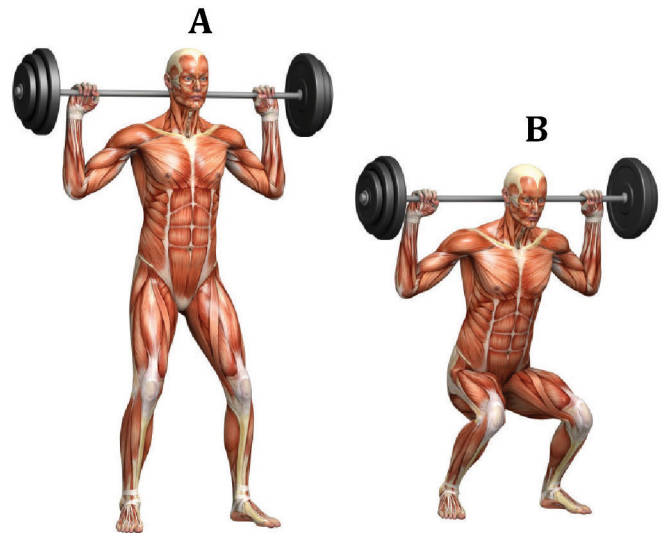


Image source:  
<https://www.acefitness.org/images/webcontent/blogs/blog-examprep-081814.jpg>

- 4.) What is the common function of the erector spinae?
  - a.) Extend the vertebral column
  - b.) Depress the scapula
  - c.) Elevate the scapula
  - d.) Flex the vertebral column

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Analysis of the norming session results and student outcomes on pre- and post-tests was conducted using SPSS statistical software, version 23 (IBM Corp. Released 2014, Armonk, NY). YA vs. Control test results as well as pre- vs. post-test results were analyzed using Independent Samples T-tests.

In addition to the pre- and post-test, all YA workshop participants completed an anonymous survey of the YA workshop following the completion of their post-test. The survey consisted of three Likert-Scale questions (scored from strongly agree to strongly disagree) evaluating the students' perceptions of Yoga Anatomy's effect on their comprehension of lecture material:

The Yoga Anatomy workshop helped me learn muscle names.

The Yoga Anatomy workshop helped me learn muscle functions/actions

The Yoga Anatomy workshop helped me apply my anatomy knowledge to a real-world example.

Nine additional Likert-Scale questions were included to assess participant satisfaction with the workshop:

How would you describe the pace of the Yoga Anatomy workshop?

How helpful was the Yoga Anatomy workshop PowerPoint presentation?

How much did you enjoy participating in the Yoga Anatomy workshop?

How interested are you in attending a similar session on another anatomy system?

Two open-ended questions provided students with a place to mention aspects of the workshop they found particularly beneficial as well as any suggestions for improving future Yoga Anatomy workshops.

The complete survey is available from authors upon request.

## YA Workshop Procedure

Yoga Anatomy workshops consisted of a PowerPoint presentation, a worksheet packet, and a series of yoga poses that demonstrated specific musculoskeletal structures and functions of the trunk and limbs. The purpose of the PowerPoint presentation and worksheet packet, created by the authors, was to engage students visually and aurally as the anatomy was introduced and discussed. All presentation slides reinforced material learned in the A215 lecture and applied that information to a specific yoga posture.

The PowerPoint and worksheet packet contained anatomical images from the course textbook (McKinley *et al.* 2014) as well as images showing the musculature of each yoga pose (Long 2009) for the students. All images in the packet were semi-labeled and contained blank spaces for students to fill-in

muscle names throughout the presentation. The presentation and worksheet packet were used intermittently as instructors would guide participants into the pose for a few moments and allow the students to feel their own muscles working before returning to the presentation and discussing the next posture. This cycle of brief presentations followed by active postures (i.e., learned information followed by personal experiences) acted as the experiential learning element of the workshop.

The Yoga Anatomy workshop format was delineated as follows:

1. Students entered the space and were given an informed consent sheet and a pre-test.
2. Pre-tests and informed consent sheets were collected and instructors led students through a five-minute integration segment. The integration segment included dynamic stretching and a brief series of yoga poses (without anatomical discussion) to orient students to the basic sequence and terminology used in yoga.
3. Students sat with closed eyes as instructors introduced an opening meditation. The meditation focused on primary respiratory musculature and the relationship between thoracic volume and pressure during inhalation and exhalation.
4. Instructors briefly reviewed muscle names, locations, and functions for a single yoga posture using a PowerPoint presentation and anatomical models. Students followed along, filling in a worksheet packet containing the semi-labeled PowerPoint muscle diagrams.
5. Instructors guided students into the posture using anatomical cues. Students then held the pose as instructors reviewed the anatomy and were directed out of the pose to repeat the process for the next yoga posture.
6. The YA workshop concluded with a closing meditation and restorative pose *Savasana* (laying supine on a yoga mat with eyes closed and deep breathing). Once instructors led students out of *Savasana*, post-tests and surveys were distributed for the students to complete before leaving the YA workshop.
7. Students were encouraged to stay after the YA workshop and ask questions or view the limb models.

Both of the identical musculoskeletal YA sessions were held in a meeting room in the Indiana University Memorial Union only two days apart to accommodate various student schedules. Students were encouraged to supply their own yoga mats, although the instructors provided a few of their own. The authors, who are experienced yoga practitioners and lab TAs of the A215 Basic Human Anatomy course, served as the YA workshop instructors.

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## Results

Analysis of the data was separated into two categories: scores from pre- and post-tests and survey responses from YA workshop participants.

### Pre- and Post-Test Scores

The data outlined in Table 3 revealed a significant difference between the treatment (YA workshop) students' test scores and control students' test scores. The mean pre-test score for YA students was 6.2 (SD = 1.6) out of a possible ten points; control participants scored an average of 5.5 points (SD = 1.3). On the post-test, YA students scored a mean of 6.5 points (SD = 1.7) and control students again scored an average of 5.5 points (SD = 1.5). YA students scored significantly higher than control students on both the pre-test ( $P = 0.047$ ) and post-test ( $P = 0.015$ ).

**Table 3.**  
Pre- and post-test scores: Intragroup Comparison

Participants	pre-test (mean $\pm$ SD)	post-test (mean $\pm$ SD)	T-value	( $P < 0.05$ )
Yoga Anatomy	6.2 $\pm$ 1.6	6.5 $\pm$ 1.7	-0.859	0.397
Control	5.5 $\pm$ 1.3	5.5 $\pm$ 1.5	0.177	0.861

Comparison	pre-test T-value	post-test T-value	pre-test ( $P < 0.05$ )	post-test ( $P < 0.05$ )
YA vs. Control	2.024	2.504	0.047	0.015

Pre- and post-tests contained 10 multiple-choice questions worth 1 point each.

**Table 4.**

Post-workshop survey results (n = 33)

Question	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
The Yoga Anatomy Workshop helped me learn muscle names.	10	17	4	2	-
The Yoga Anatomy Workshop helped me learn muscle functions (actions).	20	12	1	-	-
The Yoga Anatomy Workshop helped me apply my knowledge to a real-world example.	21	10	2	-	-
	Very Helpful 5	4	3	2	Not Helpful 1
How helpful was the Yoga Anatomy Workshop PowerPoint presentation?	11	19	3	-	-
How helpful was the Yoga Anatomy Workshop packet?	19	11	3	-	-
	Very Much 5	4	3	2	Very Little 1
How much did you enjoy participating in the Yoga Anatomy Workshop?	22	8	3	-	-

As also indicated in Table 3, YA student results did suggest a trend of improvement from pre-test ( $M = 6.2$ ,  $SD = 1.6$ ) to post-test ( $M = 6.5$ ,  $SD = 1.7$ ); however, the improvement was not significant ( $P = 0.397$ ). Control participants did not appear to improve from pre- to post-test ( $M = 5.5$  for both tests,  $SD = 1.3$  for pre-test and 1.5 for post-test,  $P = 0.861$ ).

### Survey results

Results from the voluntary post-workshop survey are highlighted in Table 4. The majority of students responded positively (e.g., "agree" or "strongly agree") to questions assessing YA workshop's impact on their knowledge of muscle names and actions, as well as their ability to apply the anatomical concepts learned to real-life examples. In addition, 82% of participants agreed that the YA workshop increased their ability to name and identify specific muscles (e.g., the names and locations of the pronator muscles), 97% agreed that the YA workshop improved their understanding of muscle actions (e.g., hamstrings flex the leg at the knee), and 94% agreed that the YA workshop increased their ability to apply their anatomical knowledge to real-life situations.

YA participants also agreed or strongly agreed that the PowerPoint presentation and worksheet packet were helpful for studying (91% each for PowerPoint and worksheet packet helpfulness). Additionally, 91% of students indicated that they enjoyed the YA workshop and all participants reported that they would be likely to recommend the YA workshop

to a classmate and would be interested in attending a similar YA workshop on a different body system.

The majority of open-ended comments reflected a positive student experience. Themes of positive comments included the perceived benefits of experiential learning ("Feeling my own muscles during each movement really helped me understand muscle

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actions.”), having a peaceful and relaxing learning environment (“I felt less stressed during the workshop than I usually do when I’m studying on my own.”), and incorporation of lecture and lab material (“Talking about the muscles while actually doing the actions helped me study lab and lecture at the same time.”). Suggestions for the project mainly fell under three categories: (1) adding more poses and posture breakdowns, (2) slowing the pace of the workshop, and (3) spending more time feeling muscle actions in the yoga poses before moving on with the anatomy discussion.

## Discussion

Experiential learning, in its most basic form, requires the use and combination of both cognitive and perceptual information. For deep learning to occur, students must use learned concepts to build upon their own experiences and create a more detailed and personally relevant understanding (Janssen *et al.* 2014, Kolb and Kolb 2005, Nicholson *et al.* 2016, Yardley *et al.* 2012). Unlike other commonly used kinesthetic learning activities, such as cadaver dissections and reviewing anatomical models, Yoga Anatomy workshops allow students to reinforce their learned anatomical knowledge by simultaneously experiencing the practical application of that knowledge within their own bodies.

Although YA students scored significantly higher than control students on both the pre-test and post-test, neither group improved significantly from pre- to post-test. One possible explanation for the limited gains could be the amount of time between the administration of the pre- and post-test. Regardless of whether students attended a YA workshop or simply had extra time in the laboratory to study on their own, one hour may not have been enough time for students to significantly improve their knowledge of the material or their application skills from pre-test to post-test. As further described in the Limitations, the authors encountered a self-selection bias in terms of YA workshop and control group participants. It is possible that the high-achieving students already possessed the material knowledge and application skills to score highly on pre- and post-tests without the extra hour of either a YA workshop or independent study time in the lab. Low-achieving students may not have had the time or the ability to both adjust their study strategies and enhance their anatomy knowledge within the one-hour time frame.

## Limitations

Yoga Anatomy students were recruited through in-class and email announcements delivered to all A215 Basic Human Anatomy students, a roster of approximately 400 undergraduate students. Flyers advertising the YA workshop were also posted near lecture and laboratory entrances. Responses from a post-YA workshop survey question revealed that most participants learned of the YA workshops through email and in-class announcements. Of the 33 YA participants, 28 students selected email and 30 students selected instructor announcements as their source of YA workshop information.

Although these recruitment methods proved effective for some students, the number of YA students was still only a fraction of the total course enrollment. Future studies may seek to revise or add recruitment measures to increase participation in future YA workshops.

The authors also encountered a self-selection bias due to the optional nature of the Yoga Anatomy workshops. Students who chose to participate in the YA workshops may have fallen on opposite ends of a spectrum: those who were already highly motivated and enthusiastic about extra learning opportunities and those who were severely struggling with course material and are desperate for new and more effective ways to study for examinations. A larger sample size could potentially lessen the effects of self-selection bias. Greater student participation in the YA workshops would increase the chances of having an even distribution of high-, moderate-, and low-achieving students. To accommodate more students, however, multiple sessions or a larger YA workshop space might be necessary.

Location and resources were the two largest challenges to the practicality of this study. Each Yoga Anatomy workshop required the following: a space large enough to fit 30-35 yoga mats that was clear of any desks or chairs; a projector and screen for the PowerPoint presentation; one table for handouts and another for the limb models. Hosting YA workshops in the campus recreational center would have been ideal as there are several enclosed rooms for various group exercise classes and most are already supplied with yoga mats, blocks, and other useful props. However, the recreational center could not provide a projector or screen and most rooms had already been reserved months in advance for weekly exercise classes. The authors recommend consulting with campus recreational centers before the beginning of each semester to reserve rooms and supplies for the Yoga Anatomy workshops.

## Future Directions

Next steps for Yoga Anatomy could include workshops reviewing additional body systems such as the cardiovascular or nervous systems. Alternate yoga postures could be selected to better demonstrate the structures and functions of each workshop topic. The authors have already piloted this idea with Yoga Anatomy workshops focusing on the cardiovascular and lymphatic systems; however, these YA workshops were not as well attended as the musculoskeletal YA workshops and were therefore not discussed. Potential explanations for the limited participation could include: the perception that these body systems are less complex or are easier to understand, a decrease in the novelty of the YA workshops, or a lack of motivation to study due to the exam’s close proximity to holidays and school breaks. The possibility of expanding YA workshop participation to medical, nursing, physical therapy, and occupational therapy students could also be explored. Dance students may also find Yoga Anatomy workshops

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beneficial, as several studies have outlined the importance of incorporating anatomy into dance curricula (Pengelly 2010, Salk 2005).

## Conclusion

Yoga, as a discipline, is both highly visual and kinesthetic; it encourages and fosters the development of body awareness and mindfulness, engaging all senses (Desikachar 1995). The addition of Yoga Anatomy workshops to an undergraduate human anatomy curriculum can be an effective teaching tool that engages students visually, kinesthetically, and experientially.

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## About the Authors

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