“On February 23, 1836, the arrival of General Antonio López de Santa Anna’s army outside San Antonio nearly caught them by surprise. Undaunted, the Texians and Tejanos prepared to defend the Alamo together. The defenders held out for 13 days against Santa Anna’s army.” (www.TheAlamo.org)
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The HAPS-EDucator is the official publication of the Human Anatomy and Physiology Society. As such, the HAPS-EDucator aims to foster the advancement of anatomy and physiology education by facilitating the collaboration of HAPS members through the publication of a biannual journal. Journal articles may include, but are not limited to, those that discuss innovative teaching techniques (e.g., the use of technology in classrooms or active learning practices), original lesson plans or lab exercises, reviews of trending topics in anatomy and physiology, and summaries of newsworthy events (e.g., seminars or conferences that not all society members can attend). Additionally, an extra issue of HAPS-EDucator will be published after the Annual Conference, highlighting the update speakers, workshops and poster presentations. All submitted articles will undergo a peer-review for educational scholarship. Articles not immediately accepted will be returned to authors with feedback and the opportunity to resubmit.

Submission Guidelines for Authors
The complete "Author Submission Packet" is available HERE.

Terms of submission
The HAPS-EDucator publishes manuscripts consisting of original material that is not currently being considered for publication by another journal, website, or book and has not previously been published. Publication of the manuscript must be approved by all of the authors and have the approval of the appropriate institution(s). Manuscripts are to be submitted electronically to editor-in-chief, Sarah Cooper at editor@hapsconnect.org. Materials for Snippets should be submitted directly to Roberta Meehan at Edu-Snippets@hapsconnect.org.

Formatting
Manuscripts are to be submitted in rich text format (.rtf.) or .docx, in Arial (10) font with 1” margins on all sides. Accompanying the text, authors should submit an Author Submission Form consisting of a title page that lists the full name, associated institution and address, and email address of each author. A short Abstract of 150 to 200 words that explains the primary thesis of the submission should be included. Photos and illustrations should not be included in the body of the manuscript but they should be submitted, clearly labeled, with the manuscript. They should be submitted in JPEG form or in some other appropriate and usable form.

References
It is the responsibility of the author to make sure that the information on each reference is complete, accurate and properly formatted. References should be included in the body of the manuscript where appropriate using the following format: Author’s last name and date of publication, (Martini 2011). A list of ‘Literature Cited’ should appear at the end of the paper alphabetically by author’s last name. Example references are available in the complete "Author Submission Packet".

Submissions are accepted at all times and should be sent to editor@hapsconnect.org.

Deadlines for specific issues are:
- March 15 for the Spring Issue
- July 15 for the Conference Issue
- November 15 for the Winter Issue

You do not need to be a member of HAPS to publish in the Educator. For more information see the complete submission guidelines using the link above.

Human and animal research subjects
Research that includes dissection and manipulation of animal tissues and organs must adhere to the Human Anatomy and Physiology Society (HAPS) Position Statement on Animal Use (Adopted July 28, 1995, modified January 2001, Approved April 29, 2012), which states that the use of biological specimens must be in strict compliance with federal legislation and the guidelines of the National Institutes of Health and the United States Department of Agriculture. The use of humans or animals in research must fulfill clearly defined educational objectives.

Experimental animals must be handled in accordance with the author’s institutional guidelines and informed consent must be obtained for studies on humans. It is the responsibility of the author(s) to secure IRB approval for research on humans.

How your submission will be handled
The editor will assign the manuscript to a minimum of 2 and a maximum of 4 members of the HAPS-EDucator editorial board for Educational Scholarship review. The reviewers will evaluate the manuscript for scientific accuracy, appropriateness to the audience, readability and grammar. The reviewers will submit their reports along with a recommendation that the manuscript be (a) published unaltered, (b) published with minor changes, (c) published with major changes or (d) not published at all. The editor will then decide what action will be taken with the manuscript and the author will be notified to prepare and submit a final copy of the manuscript with the changes suggested by the reviewers and agreed upon by the editor. Once the editor is satisfied with the final manuscript, the manuscript can be accepted for publication.

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The President’s Medal

The President’s Medal is a prestigious award given each year to a HAPS member who has provided exemplary service to our organization. I am pleased to report that Don Kelly was presented with the HAPS President’s Medal at the 2015 Annual Conference in San Antonio, Texas.

Don has been a HAPS member since 2002 and his enthusiasm has been in high gear ever since. He has presented a number of workshops at conferences and served on committees such as the Animal Use Committee, the Nominating Committee, and the Foundation Oversight Committee. For the Foundation Oversight Committee, he has done a fantastic job of developing an evaluation schedule, building scholarship review teams, and creating evaluation rubrics.

Don served as President of HAPS in 2011-2012, leading us through the selection of a new executive director, upgrade of our online presence, and expansion of the HAPS Foundation through scholarships and grants. Don has created an incredible executive director review process that has assisted the Board and will continue to assist it for years to come.

Don is the quintessential HAPS member, excited to meet new people and reacquaint with old friends each year. He always has time to share a story, toast a beer, and introduce a first-timer to a committee chair during the Scavenger Hunt. You can tease him about his cell phone proficiency and he will always smile and have a sharp, yet friendly, comment in return.

It was my honor and my pleasure to bestow Don Kelly with the 2015 HAPS President’s Medal.

Tom Lehman
2014-2015 HAPS Year in Review
A Message From Past-President Tom Lehman

It is my pleasure to share a summary of the amazing year that we have had in HAPS over the past twelve months, from July 2014 to June 2015. Ever since we wrapped up the 2014 annual conference in Jacksonville, Florida, we have been busy with an abundance of projects and events to best serve you.

The HAPS organization continues to grow in its ability and opportunity to serve its members. The Board of Directors and Steering Committee created a Strategic Plan last year, and this year they have been hard at work in implementing the goals of that plan. The infrastructure of HAPS has been upgraded, due primarily to Peter English, our executive director, and the folks at ASG, who are our business managers. Using the Hapsconnect website, we have been able to hold monthly Board meetings, store our corporate emails on a safe and reliable server, create streamlined forms and procedures for the regional and annual conferences, and much more.

We hosted regional conferences this last year in Apple Valley, Minnesota and Cincinnati, Ohio. The regional conferences scheduled for this fall will be in Salisbury, Maryland and Milwaukee, Wisconsin. This fall will mark the debut of our first international regional conference, which will be held in Melbourne, Australia in December. Check out the HAPS website for more details. More regional conferences are planned for 2016, as well as our annual conference, which will be held in Atlanta, Georgia on May 21-25, 2016.

The HAPS-Institute has broadened its appeal this year by offering its courses not only for graduate credit but also for non-credit professional development. The non-credit professional development version of the HAPS-Institute has been incredibly popular, increasing our enrollment this past year by a sizeable margin. Valerie O’Loughlin has just completed teaching a course on educational research, which saw twenty-three (23) people enrolled and more clamoring for the course to repeat. My President’s Initiative, which ramps up this coming year, will continue this growth by developing more courses to train new educators and bolster veteran educators in various aspects of teaching. This will lead up to the 2016 annual HAPS conference in Atlanta, Georgia, which has a theme of “Advancements in Anatomy & Physiology”. The Atlanta team, under the leadership of Kyla Ross and Adam Decker, is already shaping up the 30th annual HAPS conference to be a fantastic venue. You’ll be hearing more about it as the year proceeds.

San Antonio served as the location for the 2015 annual HAPS conference, and it was an incredible week. I would like to offer huge kudos to Anita Moss, Jason LaPres, and their crew for putting on an amazing conference. Past President Valerie O'Loughlin’s President’s Initiative was centered on “Educational Research”, with Update Seminars and Workshops carrying out that theme throughout the week. Valerie is hard at work, expanding the HAPS offerings related to educational research tools with a series of videos and more HAPS-I courses.

I am just scratching the surface. There are more projects and events, which you can find through our social media sites, the HAPS website, and the HAPS list-serv. Just because the conference has concluded doesn’t mean the year for HAPS is over. Oh no, it is just getting started. Buckle up and enjoy the ride.

Tom Lehman
past-president
Greetings from Your President

HAPS President Profile

I am delighted to serve HAPS as the President for the 2015-2016 academic year. Last year, as president-elect, I had the pleasure of working with Past-President Valerie O’Loughlin and President Tom Lehman. This year, together with Tom and Terry Thompson, the incoming president-elect, I plan to continue to advance the HAPS mission of promoting excellence in the teaching of anatomy & physiology. We have excellent administrative support, sound financial standing, and passionate teacher/members working together in leadership positions.

I have taught anatomy and physiology at the same institution, Tyler Junior College in east Texas, for over 30 years. One of the main factors keeping me academically and intellectually active is my involvement in professional organizations, most notably HAPS. My first HAPS meeting was in San Diego in 1992; my second, the next year, was in Beaumont, Texas. That year, I served as secretary-treasurer, only the second person ever to hold that position. We’ve come a long way since then! Having worked on the Texas Annual Conferences in 1998 and 2006, along with the Fort Worth regional in 2013 and one near Dallas in 1997, I can tell you that what used to be a few faculty throwing a meeting together has become a very sophisticated, tightly managed, and well-executed event.

Over the years, HAPS leaders have leveraged its resources, expanded its connections, and positioned HAPS as the premier professional organization for a large number of educators. This makes us able to do more to support our members, and to help our members do more to support the organization. Our ability to make a difference for our members rests in our own hands, and I urge all members to take an active part, locally, regionally, nationally, or internationally, to make HAPS a vibrant society well into the future.

We’re going to have a great year!
In The News

We are very pleased to welcome Kerry Hull, PhD. as the new Chair of the HAPS EDucator Committee.

Greetings, HAPS-EDucator readers and future article submitters! I have been attending HAPS conferences since 2008 and also serve on the HAPS Foundation and Scholarships committee. I teach Physiology, Exercise Physiology, and Anatomy at Bishop’s University, a small liberal arts institution in Southern Quebec. A molecular endocrinologist by training, I have recently transitioned to the much more satisfying enterprise of pedagogical research. I look forward to continuing projects initiated by outgoing chair Jennelle Marcos, such as streamlining the article submission process and fully integrating HAPS-EDucator into the BioSciTRC. We are always looking for new articles and ideas about how to improve the HAPS-EDucator; you can contact Sarah Cooper and myself at editor@hapsconnect.org.

Kerry Hull, HAPS EDucator Committee Chair
HAPS-Thieme Award for Excellence in Scholarship

The HAPS-Thieme award is given to recognize and reward excellence in undergraduate anatomy and physiology instruction. Individuals who demonstrate the core values of HAPS are nominated by their colleagues for this award. The winner of this year's award is Terry Thompson.

Terry is a Professor of Biological Sciences at Wor-Wic Community College in Salisbury, MD where she has been teaching anatomy and physiology since 2001. Prior to 2001, Terry had varied experience as a naturalist/educator in schools, museums, parks and field stations. She served as a field researcher/conservationist with the National Zoological Park Conservation Research Center, the Virginia Institute of Marine Science, and the Nature Conservancy. Being able to share her personal love of science and her enthusiasm for life-long learning, while involving students in hands-on experiences and critical thinking, are the things she enjoys most about teaching.

Primal Pictures and HAPS Scholarship

The Primal Pictures award is given each year to recognize and reward an undergraduate anatomy and physiology student who has shown exceptional promise. Nominations for this award are submitted by the student’s instructor. The winner of this year’s award is Shannon Gill.

Shannon holds a degree in business management from San Jose State University, and recently graduated summa cum laude with a bachelor’s degree in molecular biology and biotechnology from the University of Idaho. She has been accepted into Indiana University’s Anatomy Education PhD. program for the fall of 2015. She is looking forward to a future career as an anatomy instructor at a post-graduate institution or medical school.

HAPS Institute Scholarship

The HAPS Institute Scholarship is awarded quarterly to provide financial support to instructors of anatomy and physiology who wish to take a HAPS Institute course. The winners of this year’s awards were Wendy Riggs, Zoe Soon, Candi Heimgartner and Adedayo Adeeko.

Wendy Riggs is a tenure track biology professor at College of the Redwoods in Eureka, CA. She loves teaching and is an avid course flipper. She is also the HAPS Communication Committee chair, and is always looking for energetic HAPSters to join the “ComCom.” She invites everyone to join the fun. Email her at wriggs@hapsconnect.org for more information.

Zoe Soon has been an Instructor in the School of Health and Exercise Sciences, Faculty of Health and Social Development, University of British Columbia, Okanagan, Canada since July of 2011. She holds patents in elemental analysis of tagged biologically active materials and high-throughput screening of metabolic disorders using a laser desorption ion source coupled to a mass analyzer. Her areas of expertise include skeletal and cardiac muscle cell biology and pathophysiology.
Candi Heimgartner has been teaching anatomy and physiology for 16 years, the last 12 of which have been at the University of Idaho. She teaches approximately 300 students per semester in lecture and cadaver-based labs for which she has recently published two laboratory texts. She loves teaching and being in the classroom and in her spare time she is a 4-H leader for a livestock and horse club.

Adedayo Adeeko teaches anatomy and physiology, physiology, and pathophysiology at Sir Sandford Fleming College, a small community college in Peterborough Ontario, Canada.
She is fascinated by topics in teaching and learning including how learning happens, motivations for learning, curriculum mapping, and the scaffolding of curriculum delivery. She reports that the knowledge and experience she gained from "Introduction to Educational Research Methods" are already being put into use in the form of collaborative pedagogical research efforts.

Faculty Scholarship Award
The Faculty Scholarship Award is given for proposals that integrate innovative and/or alternative pedagogy into existing instructional programs. Grant recipients are strongly encouraged to present their project results in the form of a workshop or poster session at the annual conference following completion of the project. The winner of this year’s award is Mary Vagula.
Mary Vagula has been an associate professor of biology at Gannon University in Erie Pennsylvania since 2004, where she teaches upper level physiology to biology majors and pre-professional students. In addition to physiology, she also teaches human biology, cell biochemistry, and animal form and function. She enjoys actively engaging undergraduate students in research. Her areas of interest include pedagogical research and the development of innovative methods for teaching physiology.

Student Grant
Student grants are given for proposals that support student research projects or enrichment activities outside of their home institution. Grant recipients or their faculty sponsors are strongly encouraged to present their project results in the form of a workshop or poster presentation at the annual conference following completion of the project. The winner of this year’s student award is Sally Jo Detloff.
Sally Jo Detloff is an undergraduate student at Benedictine University in Illinois, where she is majoring in Health Sciences and minoring in Chemistry. She is passionate about anatomy, physiology and pathology. She hopes to pursue a master’s degree in biological sciences, with a focus on anatomy, after finishing her BS degree next year.

continued on next page
**Travel Awards**

The Sam Drogo Technology in the Classroom Award is given for the innovative use of technology to engage undergraduates in human anatomy and physiology. The award enables recipients to attend the HAPS annual conference where they are encouraged to conduct a workshop featuring innovations in educational technology. This year the award winners are Janet Casagrand and Louise Lexis.

Janet Casagrand is a senior instructor in the Department of Integrative Physiology at the University of Colorado at Boulder where she teaches a variety of courses including Human Physiology, and Neurophysiology. She is passionate about undergraduate education, and continually strives to improve her students’ learning experience. Janet has incorporated evidence-based learning techniques into her classroom and she is involved in science education research to explore how students learn best.

Louise Lexis is a Senior Lecturer in human physiology in the School of Life Sciences at La Trobe University in Australia. With Brianna Julien, a colleague, Louise has combined her passions for science, teaching and learning to develop an acclaimed 60-credit point advanced human physiology capstone program for final year Bachelor of Health Science students at La Trobe University. Louise is committed to providing students with the best possible opportunities to gain up-to-date physiology knowledge while also developing their research and communication skills, allowing them to become accomplished scientists and scientifically-literate citizens.

**The Robert Anthony Scholarship for New Instructors in Anatomy and Physiology**

is given to encourage faculty during their first five (5) years of teaching anatomy and physiology to network with seasoned professionals by attending the HAPS annual conference. The award pays for the registration fee at the annual conference. This year the award winners are Daniel Williams and Peter Reuter.

Daniel Williams joined the faculty of the University of St. Mary in Leavenworth, Kansas in 2013 as an assistant professor of biology. He has previously studied the effects of ice age climate change on the evolution of mammals and birds at the University of Kansas and Georgia Southern University where he also mentored students in a forensic biology research program. His current research interests include the impact of climate change on generalist mammals, such as white-tailed deer and the impact of urbanization on birds.
Peter Reuter received his medical degree as well as his research doctorate from Johannes Gutenberg University in Mainz, Germany. He worked as an orthopedic surgeon in England before switching his main focus to compiling medical and scientific dictionaries and databases for print and digital publications. In 1998 Dr. Reuter moved to Florida and founded Reuter Medical Inc., a reference publishing company. He has published or contributed to more than 100 dictionaries in six languages and 19 countries. Dr. Reuter is an assistant professor at the College of Health Professions & Social Work at Florida Gulf Coast University (FGCU) where he is a lecturer for both basic and advanced A&P I and II, as well as the course coordinator for adjunct instructors and lab sessions.

The Contingent Faculty Scholarship award is given to encourage part-time faculty, temporary contract length faculty, and faculty teaching at more than one institution to achieve full-time employment, to network with seasoned professionals by attending the HAPS annual conference. The award covers the registration fee at the annual conference. This year’s winner is Anya Goldina.

Anya Goldina is originally from the Ukraine. She has taught anatomy and physiology and general biology at Elizabethtown College in Pennsylvania since 2012. She enjoys teaching and the challenge of learning effective ways to teach anatomy and physiology. When she is not working, she enjoys spending time with her daughter, traveling, hiking and exploring ethnic foods.

The HAPS Graduate Student/Postdoctoral Travel Award is given to enable a graduate or postdoctoral student to attend the HAPS annual conference and deliver a presentation there. Along with this award, the registration fee for the annual conference is waived. This year’s winner is Christine Yu.

Christine Yu is a graduate student pursuing a PhD degree in Human Development in the Counseling and Educational Psychology Department in the School of Education at Indiana University, Bloomington, Indiana. Her degree includes a concentration in human anatomy. While studying at IUB, she has been an associate instructor for undergraduate human anatomy, early childhood development, adolescent development, and lifespan development. Beginning in July 2015, Christine will be working as the Anatomy Lab Diener Coordinator in the College of Osteopathic Medicine at Marian University in Indianapolis, IN.

2016 Conference Candids
Synapse HAPS: A Rapid, New Form of Knowledge Transmission

Keely Cassidy
Indiana University, Medical Sciences Program
1001 E. 3rd St., Jordan Hall 104, Bloomington, IN 47405

Abstract:
The annual meeting in San Antonio was the first time that HAPS members experienced the unique presentation format of Synapse HAPS. Seven experienced HAPS members, educators and researchers took the stage to address various anatomy and physiology topics in five minutes with auto-advancing slides and no time for audience questions. The fast-paced environment and diverse content made for a compelling hour, and fostered discussions well after the presentations were finished.

Discussion
A new conference event, Synapse HAPS, had its debut at the 29th HAPS Annual Conference in San Antonio, Texas during the weekend update seminars. This dynamic presentation format invited seven long-time HAPS members and experienced speakers to each give a quick talk the format of which was loosely based on a series called “Ignite!” Each presenter had five minutes to speak about an anatomy and/or physiology topic of his or her choice accompanied by auto-advancing PowerPoint slides. Rather than having a long, in-depth review of a large topic, Synapse HAPS was designed to take a quick look at a small topic. There was no time allotted for questions at the end of a presentation because the goal was to create a fast-paced environment that was in some ways a stark contrast to the update speakers. The topics the seven speakers chose varied from teaching resources and pedagogical research to anatomical and physiological content and ongoing research.

Miranda Byse, American Physiology Society, demonstrated the “Life Science Teaching Resource Community (LifeSciTRC)” website to attendees. She emphasized that the LifeSciTRC is a free tool available to all life science educators and contains a wealth of information compiled by a partnership of life science organizations, including HAPS. The creative commons license means that users may use any resource in the LifeSciTRC as long as credit is attributed to the original author. All submissions to the website are peer reviewed and evaluated for scientific accuracy and appropriate use of humans and animals, so users can count on these materials being accurate and up to date.

Kyla Ross, Georgia State University, used her background as a biomedical engineer to remind HAPS members that basic scientific principles are essential for complete and coherent student understanding of physiological concepts. In “Physiology: An Engineer’s Perspective,” Ross walked attendees through examples, such as Poiseuille’s Law, utilizing specific questions about the cardiovascular system. She emphasized that with the increasing prevalence of interdisciplinary education, instructors must relate new information to what students already know.

Wendy Riggs, College of the Redwoods, began by stating, “In the last three years, I’ve flipped every class I taught except one. And that one just reinforced my commitment to the pedagogy. In “Beyond the Flip,” Riggs explained that flipping a classroom is only part of the equation for one type of successful classroom environment. This pedagogical method enables her to try more active learning techniques, to give students more access to her during class, and to act as the coach they so often need when navigating new or unfamiliar content. Riggs underscored her experiences with the mantra, “You are more than your pedagogy; “You are more than your content.”

Margaret Weck of the St. Louis College of Pharmacy, told attendees that because students focus their attention on what we – as teachers – assess, we need to be more thoughtful about what and how we assess. “The Centrality of Assessment to Quality Instruction” explained that instructors must first know what is important about what we teach, and then assess it in ways that help students to clarify the meaning of the material. This involves understanding how what we teach is connected to what is important to our students, whether this is via foundational assumptions, epistemology and rules of evidence, context, or relevance. This pedagogical metacognition is an important aspect of teaching because it is essential to clarifying meaning and forming long-term memories.

J. Bradley Barger, Indiana University, spoke about “Visual Literacy in Anatomy.” Using a series of anatomical images (e.g., kidney model, limb x-rays and a transverse section of the body), Barger asked the audience to think about what it means to think or see like an anatomist. He said, “A picture is worth a thousand words…but to whom?” Barger then showed a sequence of images from various disciplines (e.g., internal combustion engine, tree leaf identification, knitting patterns), and asked the audience to really

continued on next page
Conclusions

The first year of the Synapse HAPS event had a fantastic audience turnout, and a stellar cadre of knowledgeable presenters. The hope that this session would lead to networking between individuals in the audience as well as spark some lively conversation outside of the presentation time was realized and helped to make this new event a success. There are already plans in place for another session of Synapse HAPS at the 2016 annual meeting in Atlanta, with details to come as the conference approaches. If you would like to participate, please feel free to email the Synapse HAPS Director, Keely Cassidy, at kcassidy@hapsconnect.org for more information about the current submission process and presentation format.

Keely Cassidy is in her final year of the Anatomy Education-track doctorate through the Medical Sciences Program at Indiana University. At Indiana University, Keely developed and has taught an upper-level undergraduate embryology course for three years. She has also taught the laboratory components of both medical gross anatomy and neuroscience and of undergraduate histology and basic human anatomy, as well as an undergraduate course for study skills in the anatomical sciences. She is currently designing an undergraduate seminar course about the history and current use of cadaveric donors in medical education. Keely’s doctoral research focuses on the presence of embryology in the medical curriculum, and the perceptions of current faculty and first-year medical students regarding the subject of embryology. In her spare time Keely enjoys hiking, training her dogs, and reading. kcassidy@hapsconnect.org

SYNAPSE = Fun! SYNAPSE = Informative! SYNAPSE = great!

Gary-Heiko Heisermann
Biology Department, Winona State University, Winona, MN

The short talks that comprised the SYNAPSE session of the Annual Conference in San Antonio were just wonderful! In rapid succession we got to see the 5-minute, auto-advancing slide “format” used for several different purposes, including a short but sweet presentation of information introducing a different perspective for teaching/learning A&P, or a sales pitch for a new pedagogical cause.

The talks were fun, entertaining, and informative. I won’t claim that there was not a dry eye in the house, but I think I can safely say that very few people were checking their messages during the presentations (or even right afterwards). I suspect I was just one of many who were already thinking of topics that could be presented in this format at a future conference.

I want to mention “fun” one more time, because another thought I had was that this format seemed very enjoyable for the presenters as well as for the audience. So... might this format be adapted for students presenting to other students? Of course it would depend on the specific course and the nature of the students in the course. It would be interesting to see how that might work, and it might work in more than one way. Thus I hope many people will try the 5-minute SYNAPSE format and let us know how it worked for them.
A Collection of Active Learning Techniques Used to Maximize Student Engagement in An Advanced Physiology Course

Mari K. Hopper, PhD
Department of Cellular and Integrative Physiology
Indiana University School of Medicine, Evansville, IN 47712

Abstract
Due to effects on student learning and success, student engagement (SE) has become a primary focus for both educators and administrators. SE was assessed using a validated SE survey (Ahfeldt et al. 2005) in all courses taught by a single professor over the course of one year. Courses included: two sections of Biology 121 Anatomy and Physiology (traditional and hybrid); and Biology 333 Animal Physiology and a newly developed course titled Advanced Human Physiology in Health and Disease (Biology 433). SE scores were comparable to results reported by Ahfeldt et al. (2005) and others. Improving SE was a primary objective when designing a new course offering in Advanced Human Physiology. Multiple active learning techniques were employed during the course of the semester. Near the end of the semester, SE was assessed in the Advanced Physiology course and was significantly higher (p<0.001) than both the Anatomy and Physiology and Animal Physiology courses. Learning techniques used to enhance SE are shared in this manuscript.

**Mari Hopper presented a poster on this study at the 29th Annual HAPS Conference in San Antonio, Texas in May 2015.**

Introduction
Student engagement (SE) has become a primary focus for both educators and administrators. Axelson and Flick (2010) sum it up best when they state: “Few terms in the lexicon of higher education today are invoked more frequently, and in more varied ways, than engagement. None (except perhaps funding) is employed more often to describe what institutions want to generate more of.” Although engagement is difficult to define, published evidence indicates that SE has desirable effects on student learning and success during college (Hu et al. 2008, Kuh et al. 2008). As a result, faculty have been encouraged to develop teaching techniques that employ active learning techniques known to engage students.

Student engagement was a major objective in a newly developed biology elective course in Advanced Human Physiology at a midsize public university. A 14 question survey developed and validated by Ahfeldt et al. (2005) was selected to assess SE. Student engagement scores were significantly higher in the Advanced Physiology course than all other physiology based courses taught by the same professor. The aim of this article is to share methods used to enhance SE in the Advanced Physiology course.

Methods
The first step in designing an engaging course was to research instruments that could be utilized to assess engagement. Review of the literature proved to be somewhat overwhelming as there are a vast number of assessment instruments utilized at both the institutional and classroom level. A sampling of these instruments is shared in Table 1*
### Table 1. Sample of Engagement Instruments

**INSTITUTIONAL:**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Survey of Student Engagement (NSSE)</td>
<td>Indiana University</td>
</tr>
<tr>
<td>Community College Survey of Student Engagement (CCSSE)</td>
<td>Indiana University</td>
</tr>
<tr>
<td>Faculty Survey of Student Engagement (FSSE)</td>
<td>Indiana University</td>
</tr>
<tr>
<td>Beginning College Survey of Student Engagement (BCSSE)</td>
<td>Indiana University</td>
</tr>
<tr>
<td>Cooperative Institutional Research Program (CIRP)</td>
<td>UCLA</td>
</tr>
<tr>
<td>Your First College Year (YFCY)</td>
<td>UCLA (follow-up CIRP)</td>
</tr>
<tr>
<td>Academic Engagement Index</td>
<td>Schreiner 2004</td>
</tr>
<tr>
<td>Student Information Form (SIF) survey</td>
<td>Borden 1988</td>
</tr>
<tr>
<td>eVALUate</td>
<td>Oliver et al. 2008</td>
</tr>
<tr>
<td>First Year Initiative</td>
<td>Eck et al. 2007</td>
</tr>
<tr>
<td>Collegiate Learning Assessment</td>
<td>Council for Aid to Ed</td>
</tr>
</tbody>
</table>

**CLASSROOM:**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapted NSSE 14 Item Survey</td>
<td>Ahlfeldt et al. 2005</td>
</tr>
<tr>
<td>Student Course Engagement Questionnaire (SCEQ)</td>
<td>Handelsman et al. 2005</td>
</tr>
<tr>
<td>Classroom Behavioral Analysis System (CBAS)</td>
<td>Bulger et al. 2008</td>
</tr>
<tr>
<td>Classroom Survey of Student Engagement (CLASSE)</td>
<td>Indiana University</td>
</tr>
</tbody>
</table>

The National Survey of Student Engagement (NSSE) is most commonly used by colleges and universities to assess campus-wide practices and policies that impact SE. After learning the NSSE was annually administered on campus, it seemed most feasible to utilize the classroom instrument developed by Ahfeldt et al. (2005) as it drew 14 questions directly from the NSSE. Therefore, classroom engagement could be compared to campus wide engagement via comparison of scores for the select questions.

Prior to administering the survey, the Institutional Review Board approved the study for Use of Human Subjects in Research and informed consent was obtained. (IRB #461630.3) Participants did not receive compensation of any kind. The Ahfeldt survey (Table 2) was administered in all courses taught during the academic year 2013-2014.

### Table 2. A Survey of Student Engagement (Ahfeldt et al. 2005)

*Scale: 4: very often; 3: often; 2: occasionally; 1: never*

#### A. Collaborative learning

During your class, about how often have you done each of the following?

1. **Asked questions during class or contributed to class discussions**
   | 4 | 3 | 2 | 1 |
2. **Worked with other students on projects during class time**
   | 4 | 3 | 2 | 1 |
3. **Worked with classmates outside of class to complete assignments**
   | 4 | 3 | 2 | 1 |
4. **Tutored or taught the class materials to other students in the class**
   | 4 | 3 | 2 | 1 |

Subscore: **continued on next page**
### B. Cognitive development
To what extent has this course emphasized the mental activities listed below?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Memorizing facts, ideas or methods from your course and readings so you can repeat them in almost the same form (for example, inversed)</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>6. Analyzing the basic elements of an idea, experience or theory such as examining a specific case or situation in depth and considering its components</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>7. Synthesizing and organizing ideas, information, or experiences into new, more complicated interpretations and relationships</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>8. Evaluating the value of information, arguments, or methods such as examining how others gathered and interpreted data and assessing and accuracy of their conclusions.</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>9. Applying theories and/or concepts to practical problems or in new situations</td>
<td>4 3 2 1</td>
</tr>
</tbody>
</table>

**Subscore**

### C. Personal skills development
To what extent has this course contributed to your knowledge, skills, and personal development in the following ways?

<table>
<thead>
<tr>
<th>Skill Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Acquiring job or career related knowledge and skills</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>11. Writing clearly, accurately, and effectively</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>12. Thinking critically and/or analytically</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>13. Learning effectively on your own, so you can identify, research, and complete a given task</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>14. Working effectively with other individuals</td>
<td>4 3 2 1</td>
</tr>
</tbody>
</table>

**Subscore**

**SUM ENGAGEMENT SCORE**

The courses included two separate sections of Biology 121 Anatomy and Physiology 1 (one traditional and one hybrid); Biology 333 Animal Physiology; and the newly developed Biology 433 Advanced Human Physiology in Health and Disease.

When designing the Advanced Physiology course, a primary aim was to maximize SE by incorporating a variety of active learning and critical thinking activities. A brief description of activities follows:

1. **Classroom discussion**
   The course was a literature-based course that relied heavily on the discussion method outlined in William Fawcett Hill’s learning through discussion (Rabow and Hill 1994). In the text, an interesting analysis of the learner is presented: “Typical students know what to expect in the traditional lecture situation, but (have) little or no experience with the discussion method. Thus, even the most highly motivated students have difficulty, because they have no pattern of a good group and no clear image of the kind of behavior that would contribute to building one.” Therefore, the first week of the course was spent introducing the discussion method and getting students to “buy in” to the value. Students read articles outlining the discussion method and how it proved valuable in other classroom settings (Dallimore *et al.* 2004, Gottschalk 1994).
Students were introduced to the concept of meta-cognition and asked to self-identify the type of discussion participant they believed they most resembled (Table 3).

| Types of Discussion Participants Adapted from: (Gottschalk 1994, Rabow and Hill 1994) |
|----------------------------------|-------------------------------------------------|
| • The silent one – listens but fails to vocalize |
| • The over participant – dominates the conversation and quiets other voices |
| • The wonderer – has difficulty focusing and clarifying own thoughts |
| • The tangent person – easily gets off topic and leads the discussion in other directions |
| • The story teller – often due to poor preparation or understanding of materials tends to share personal experiences instead of addressing topic directly |
| • The insecure talker – has good thoughts, tries to speak up, but it never comes out quite right |
| • The lone dissenter – likes to be the “devil’s advocate,” looks at things differently, challenges conventional thinking |

Students were then prompted to think about what type of discussion participant they would like to become and were encouraged to share steps they planned to take to become the type of participant they most valued. Students also became aware of and practiced drawing other types of participants into the conversation. To keep students talking, each class began with a warm up question requiring every student to respond. Questions were often related to science news, information from reading assignments, or simply items that allowed students to get to know one another better (what is your favorite color, what is your best study environment, or describe your best friend).

2. Scientific argument
Students were provided instruction on scientific argumentation (Simon et al. 2006) and required to use scientific argument when discussing journals. Students were expected to move away from statements based on opinions and beliefs (such as “I feel...” or “I believe”) and move towards statements that included reported (empirical) evidence (for example, “Based on the data presented by Brown et al., I would conclude that...”).

3. Problem solving
Students were provided with many opportunities for problem solving beginning the first week of class. One class period consisted of only two slides. The first slide presented the top 10 causes of death in the US. In small groups students discussed what factors contribute to the development of these diseases, patterns or common features, and ways to predict changes in prevalence over the next decade/century. Students were then presented the second slide, the top 10 causes of death globally. Again, in small groups, students discussed how the two lists differed, why they differed, and what could be done to address disease in both scenarios.

4. Understanding Primary Literature
Students were asked to define what is meant by “primary” literature. They were asked to find an article of interest and dissect the parts (what is included in the Introduction, Methods, Results and Discussion). Students were given a primary article with the discussion/conclusions removed and as a group wrote their own conclusions. Students were encouraged to look closely at the data and the way it was analyzed. The instructor also provided examples of well written and not so well written articles and students were asked to identify the features of each.

5. Synthesis and application
Although students applied these skills almost daily, a memorable example included a guest presentation by a cell biologist. Prior to reading and discussing the two classic articles: “Hallmarks of Cancer” (Hanahan and Weinberg 2000) and “Hallmarks of cancer: the next generation” (Hanahan and Weinberg 2011), a guest speaker reviewed key events of the cell cycle as they relate to cancer development. When reading the articles, the students were able to tie together cell biology with systems physiology, and pathophysiology.

6. Collaboration
One group exam (midterm) was developed to promote collaboration. Students were allowed the opportunity to discuss the exam in assigned small groups for half the class period (approximately 40 minutes) and then return to their seats to write the exam individually. All students participated in the discussion, no one opted out. The second and final course exam was a group project. Students were instructed to develop a 30-minute lesson for seventh graders based on what
they had learned about obesity and its associated risks for disease development. Students were assigned to groups of three, and were given the grading rubric in advance. Although students did not go out into local junior high schools to actually teach the lesson, it would have been a meaningful experience to do so as a service component of the course.

7. Critical review
Perhaps one of the most controversial (and as a result engaging) activities of the semester was viewing the documentary “Forks over Knives” (available via Netflix and Hulu). While viewing the film, students were asked to record as many claims as possible. Claims were summarized on the board and students then chose one claim to either support or refute using primary literature. Students were allowed one week to research the claim, and then returned to the classroom to share their findings. Students were very surprised to learn that MANY claims made in the movie could not be substantiated with empirical data from the literature.

8. Leadership
Throughout the semester, students were assigned in pairs as discussion leaders for the day. Student leaders met with the instructor at least three days prior to class to talk about assigned reading and identify the key features for discussion. Leaders were given the following eight-step process adapted from William Fawcett Hill’s Learning Through Discussion (Rabow and Hill 1994) to help them guide the discussion (Table 4). All students were encouraged to follow the eight steps when reading the literature.

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<td><strong>TOTAL</strong></td>
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</table>
9. Technology
Individual students were assigned as note taker for the day during at least two class periods. When assigned to this role, the student focused entirely on taking good notes and did not participate in discussion (sometimes this was nearly impossible!). Note takers then organized and summarized the notes and posted to our class Wiki in Blackboard.

10. Reflection
Students were required to choose any two Wiki posts, one before midterm, and one after midterm, to expand upon. They were encouraged to find additional information, or offer alternative explanations and insight not covered in class. Students enjoyed being able to choose the topics of most interest to them personally, and delve deeper into the subject. Some students even proposed future studies that might be conducted.

11. Perspective
For one class period, each student was asked to wear a different “hat” or to represent a different profession (doctor, teacher, businessman, geneticist, cancer survivor, stay at home mother, the Pope) as we discussed how obesity impacts our society. To allow rapid identification of the role each student played, small “table tents” were placed in front of each person. This exercise was very effective in getting students to draw one another into the conversation. Students invited one another into the conversation with comments such as “I would like to hear the geneticist’s point of view” or “perhaps a mother would think differently, please share with us.”

12. Evaluation
Students were assigned readings from Time magazine and a NY Times Best Seller (Non-fiction). While reading, students were asked to evaluate both the style of writing (how it differed from traditional scientific writing) and the content of the publication. Students were asked to look for primary literature referred to in the popular press and evaluate interpretation of the data (did the author get the facts straight, was information oversimplified, was the data explained in a way that was easy for the non-scientist to understand?).

13. Integration
Students were required to attend two presentations, either an oral presentation or a poster presentation, at the annual university wide Research Symposium. Students were then required to write a one page brief on what they learned and how the ideas presented impacted them as future professionals and citizens.

14. Synthesis
As a culminating project, each student selected one disease and wrote a review paper. Although time did not allow for full presentation of findings, each student was allowed 10 minutes to share the most salient points of their research. For grading purposes, focus was on the written work. Presentations were kept informal, and students gathered and shared information as if talking to colleagues in a coffee shop.

Results
Administration of the validated survey by Ahfeldt et al. (2005) revealed that student self-reported engagement was significantly higher in the Advanced Physiology course when compare to all other courses taught during the year (data reported elsewhere). End of course anonymous student evaluations also generated many positive student comments:

“This class not only taught biology, but also improved my self-confidence. I believe I can think more critically and apply my knowledge to the world around me.”

“After taking this course I feel like a more confident speaker, thinker, and I am much better at discussing and conveying my thoughts. “

“This class allowed me to gain confidence in my ability to answer my own questions. I have learned to think more critically.”

“This course should be strongly recommended, if not required, for science majors looking to take their education to the next level.”

Remarks from the department chair were also positive, and the idea of incorporating the class into the curriculum as a senior level “capstone” course for biology majors was discussed.
Conclusions
One could conclude that the primary aim of engaging students through multiple planned activities was accomplished in the newly developed Advanced Physiology course. High levels of SE in the Advanced Physiology course provided evidence for making changes in other courses.

However, due to the self-reported nature of the engagement survey, one must ask: Did students learn more in this environment? Did students retain information longer? Did students develop skills they did not possess prior to participation? This study did not include controls, and therefore, it is not possible to assess differences in student learning. Students were primarily seniors who enrolled in the course during their final semester on campus. Therefore, tracking retention of knowledge and impact on skill development would be difficult. Additionally, finding an instrument to accurately assess improvements in analytical and critical thinking, resulting as a direct consequence of course participation, would be useful but very few such instruments are available.

It is also possible that highly engaged students self-selected into this course, and outcomes of the course could not be attributed to the embedded activities. Astin and Lee (2003) surmise that “As much as 86% of the variance in student outcomes can be explained solely on the basis of entering student characteristics.” If Astin and Lee are correct, it is possible that classroom activities that were successful in influencing students’ perceived engagement, did not actually enhance learning or skill development.

As faculty we are trained to plan for and assess student learning outcomes. We are also encouraged to employ engaging student activities. Although engaged students self-report enhanced learning and development of skills such as critical thinking, analysis and synthesis, there are few good measures for assessing the direct effect of engagement on learning. This challenge remains before us not only to engage our students, but also to determine the specific impact of engagement on learning.

* Special thanks to Kathleen Mooney at the UNCG Serve Center for assistance in compiling the list for Table 1.

References Cited:


An Undergraduate Physiology Laboratory Module of Salivary Cortisol Measurement with an Emphasis on Circadian Rhythmicity and Quantitative Analysis

He Liu and Mary C. Vagula
Department of Biology, Morosky College of Health Professions and Sciences, Gannon University, Erie, PA

Abstract
An undergraduate physiology lab module was developed to enhance student understanding of the functions of cortisol hormone, the circadian rhythm associated with cortisol release, proper ELISA technique, and quantitative data analysis methods including linear regression and t-test assessment. The statistical analysis was accomplished using Microsoft Excel. Students measured their cortisol levels in saliva samples collected in late evening and early morning using an ELISA kit. Both subjective and objective assessments showed that the learning objectives were successfully achieved.

** He Liu and Mary Vagula presented a poster on this laboratory module at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.

Key words: undergraduate education, physiology lab, salivary cortisol, circadian rhythm, sleep

Introduction
The National Research Council recommended that "a new biology curriculum" should include quantitative principles and skills (National Research Council 2003, 2009), which are not commonly included in biology laboratory courses. In addition, many physiology laboratory courses lack components of biochemical methods and activities related to the human endocrine system or circadian rhythms. Taking advantage of the circadian rhythmicity of cortisol, which has a low level in the evening and a high level in the morning (Wehr et al. 2001, Kim et al. 2015), we developed a lab module for students interested in the health care professions and other biology majors. Students used an ELISA kit to measure their cortisol levels in saliva samples that were collected in late evening and early morning. Microsoft Excel was used to analyze the experimental data. Our goals were to enhance student understanding of human endocrine physiology and circadian rhythms, and to introduce quantitative skills such as linear regression and statistical hypothesis testing to undergraduate students. Both subjective and objective assessments, including a post-lab questionnaire and homework lab report grades, showed that the goals were successfully achieved. The use of student cortisol measurement data and the publication of feedback results were approved by the Institutional Review Board at Gannon University, #15-02-05.

Material and Methods

Materials Needed: Ultrasensitive Cortisol Saliva ELISA Assay Kit (Eagle Biosciences, Nashua, NH) was purchased for this lab. One kit (96 wells) is sufficient for 44 students as well as for a set of wells needed to construct the standard curve. In addition, a microplate reader (Promega, Madison, WI) equipped with a 450nm filter, a vacuum apparatus, micropipettes and tips, and a horizontal shaker, were used for this exercise.

Sample collection: Students were instructed to collect saliva samples at home before and after sleep. After brushing teeth and rinsing mouth thoroughly with water, students waited 10 minutes to accumulate saliva in the floor of the mouth. Saliva samples were collected by tilting the head forward and letting the saliva flow into microcentrifuge tubes. Microcentrifuge tubes of two colors were given to students to avoid mislabeling (blue for night and red for morning). Students kept the samples frozen prior to submission, and instructors froze the samples again prior to the lab. Freeze/thaw cycles do not alter cortisol concentration but will prevent odor from developing in the saliva samples (Kalman & Grahn 2004). For privacy protection, collected samples were taken from students, re-labeled with numbers, and distributed randomly back to the students before measurements were taken.

Cortisol measurement: Cortisol levels were measured following the ELISA kit instruction manual. Saliva samples, the antibody, and Cortisol Horseradish Peroxidase (HRP) conjugate reagent were mixed

continued on next page
in wells pre-coated with goat anti-rabbit γ-globulin and incubated at room temperature for 60 minutes on a shaker. After the incubation, students used a vacuum apparatus to wash the wells. Then the color development reagent was added to each well and incubated for another 30 minutes before the stop solution was added to stop the color development. The optical density (O.D.) was read using a microplate reader with a 450 nm filter. The plate O.D. data was sent to students by email.

Learning objective assessments: Following the exercise, students completed a lab report with questions based on their knowledge of cortisol physiology and the results/conclusions of the data analysis. In addition to lab reports, students also completed a questionnaire anonymously that provided subjective feedback on this lab (Table 2).

Results

Class activity: Repeated measurements of the standards showed little variation. Therefore, one set of standard measurements was shared across multiple lab sections. The standard measurements can be made by the instructor prior to the lab or with students during the lab. Students were divided into groups of four and each group worked on one strip of eight ELISA wells. The ELISA procedure includes two incubation periods: a 60-minute incubation for antibody binding and a 30-minute incubation for color development. During the first incubation period, students were given a lecture on topics including the endocrine system, circadian rhythms, the ELISA method, linear regression, and hypothesis testing. Students were shown how to construct an ELISA standard curve with linear regression and a paired t-test. During the second incubation period, students were given Microsoft-Excel files to practice computer-based data analysis skills. Pre-recorded demonstration videos were provided to assist students through the practice during the lab and data analysis after the lab.

Student lab results: The log-log model was used in standard curve construction for its simplicity (Plikaytis et al. 1991) (Table 1, Figure 1B). In the student data, a 3-fold difference was observed between evening and morning salivary cortisol levels (Figure 1C). The difference was visible during and after color development (Figure 1A).

Assessment: Four multiple-choice questions were included in the student questionnaire to rate the effectiveness of this lab. For each question, students were given choices of “Not at all (none)”, “A little bit”, “Some”, “A lot”, and “Definitely a lot”. For quantitative analysis, the answers were weighted with a 5-point scale with 1 being “none” and 5 being “definitely a lot”. The questions and the distributions of the answers are shown in Table 2 and Figure 2. Student responses were positive for the first two questions in the questionnaire.
Table 1. Standard Measurements

<table>
<thead>
<tr>
<th>Standard</th>
<th>OD</th>
<th>Concentration (ng/ml)</th>
<th>log(OD)</th>
<th>log(concentration)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1.832</td>
<td>0</td>
<td>0.176</td>
<td>-1.000</td>
</tr>
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<td>#2</td>
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Table 2. Student Feedback in the Post-lab Questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Average Score + SEM (n=27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well did this lab help you to improve your knowledge on the endocrine system?</td>
<td>3.41±0.15</td>
</tr>
<tr>
<td>How well did this lab help you to improve your knowledge on the circadian rhythm?</td>
<td>3.41±0.14</td>
</tr>
<tr>
<td>How well did this lab help you to improve your knowledge on ELISA as a common medical laboratory method?</td>
<td>3.78±0.17</td>
</tr>
<tr>
<td>How well did this lab help you to improve your knowledge on data analysis with Microsoft Excel?</td>
<td>3.56±0.17</td>
</tr>
</tbody>
</table>

How well did this lab help you to improve your knowledge on ____?

Figure 2. Distribution of students’ responses to the post-lab questionnaire

Discussion

The student feedback was positive to the first two questions in the questionnaire about knowledge of the endocrine system and circadian rhythms. This meets our objective to enhance student
understanding of the physiological functions that had been covered in lecture courses prior to the lab. The last two questions regarding the ELISA method and data analysis also received positive student responses, which meets our goal of strengthening the experimental and quantitative analytical skills of undergraduate students.

Student errors were common since none of the students had previously used the ELISA method. Many students were even unfamiliar with pipetting, which indicates that this lab module is a valuable addition to our physiology lab curriculum. However, due to the significant difference between evening and morning cortisol levels (visible even during color development, see Figure 1A), students were able to reach the correct statistical conclusion, which is that human cortisol levels are significantly different between morning and evening. We feel that this lab exercise is almost foolproof due to the naturally robust circadian rhythm fluctuations in cortisol levels. Therefore we believe that this lab is suitable for an undergraduate course with a laboratory component.

**Literature Cited:**


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**About the Authors**

He Liu, Ph.D., is an assistant professor of biology at Gannon University. His research focuses on the molecular basis of animal physiology and behavior.

Mary Vagula is an associate professor of biology at Gannon University, Erie, PA. She teaches physiology, human biology and cell biochemistry to undergraduate students. Her research interests include PBDE induced toxicity studies in rodents and human cells, diabetes studies and pedagogical research focusing on innovative teaching methods in physiology.
Engaging Undergraduate Students in Human Anatomy and Physiology Courses: Review of Poster Presentations from the HAPS 2015 Annual Conference

Benjamin Miller, Ph.D.
Assistant Professor of Biology, Texas Wesleyan University
Fort Worth, Texas

Abstract
Here I will review a selection of posters presented at the HAPS 2015 Annual Conference that were geared toward engaging students in the Human Anatomy and Physiology (A&P) classroom and laboratory. The impetus of this pedagogical focus is to provide a collection of common techniques that our Anatomy and Physiology colleagues are using inside and outside the classroom to enhance student success. Indeed, it has been increasingly clear that student success is in part driven by the curricular design of the course content and by students’ self-motivation. Appropriate design is particularly important in A&P courses as there is a torrent of content that can be harnessed to drive student success. How to harness the correct tools available at our disposable can be a daunting task. My goal is to summarize some interesting ideas that have been introduced into the classrooms of HAPS members, with the goal of either inspiring others to adopt what was presented or sparking new ideas about how we teach anatomy and physiology.

Introduction
I think that all of us would agree that faculty pride ourselves as being lifelong learners. After all, that was probably a major driving force for our career choice. We as A&P (all STEM fields included) instructors, therefore, should not stop learning how to teach. In fact, I would posit that most HAPS members accrue many hours of pedagogical professional development through HAPS and other venues.

It is common to discuss and present alternate pedagogical styles at HAPS conferences, which I think is done superbly. The problem is that there are numerous pedagogical styles used to enhance student success in the classroom. Therefore, one often has a hard time disseminating what might be best for her or his classroom. Also important to recognize, is that there is no one-size-fits all approach for different institutions. For example, it can be difficult for some schools to allocate appropriate funds in the budget to purchase laboratory equipment and technology, such as cadaver labs and physiological data collection suites. For other schools, it could be difficult to incorporate face-to-face learning because of ballooning class sizes. The key of this review is to briefly cover some common themes from pedagogical posters that focused on enhancing undergraduate engagement and success in the A&P classroom. Hopefully those colleagues who were unable to attend the poster session can get a sample of the great work that was presented.

I note that I will include mostly the objective perspectives of the posters, but without compromising the authors’ scientific endeavors (i.e., I will not discuss explicit findings, such as data/figures and ultimate results) so that they have the opportunity to submit their work for peer-review in other outlets. Therefore, I will only briefly summarize the authors’ findings and include some subjective thoughts, which were garnered by the wonderful conversations on the poster floor. For detailed descriptions of the posters cited here, please see the abstracts and/or contact the authors.

Critical thinking: A&P misconceptions
The cornerstone of any scientific pursuit is critical thinking. Indeed, enhancing critical thinking is in line with what has been outlined by the National Research Council (NRC 2007) and the Vision and Change in Undergraduate Biology Education: A Call to Action (AAAS 2009) as pertinent action items for the STEM fields. It is common, especially in entry-level science classes for students to lack critical thinking skills. The lack of critical skills, moreover, poses a greater challenge as students often enter A&P courses with common misconceptions. Wright and colleagues presented how understanding specific misconceptions about homeostasis can improve student learning (Wright 2015). By obtaining feedback from attendees at a HAPS 2012 workshop, the authors were able to compile some of the most common homeostasis misconceptions. Categories of misconception were identified, for example, as flawed mental model or false belief etc. The importance of this work is that we, as a Society, should begin to compile these misconceptions so that we can address them in our curriculum. I too have been incorporating misconceptions in the A&P lectures. I have found, albeit anecdotally, that students enjoyed learning that what they once considered to be a scientific truth was flawed, and why critical thinking
can lead them to the right answer (Miller 2012).

The important aspect about teaching misconceptions is that students learn the scientific process so that they are not hand-cuffed to a textbook. I trust that all of our students will leave their anatomy and physiology courses being able to correctly analyze and address the flawed reasoning behind such misconceptions as: “negative feedback is detrimental for the body; positive is better for the body” (Wright 2015), and “fat is always bad for the body” (Miller 2012).

**Redesigning the laboratory**

The beauty of the anatomy and physiology laboratory is that it fosters hands-on scientific training; both skill building and hypothesis testing. Moreover, it often gives instructors much needed face-to-face time with students. The differences in how we each organize and deliver our lab sessions, however, are almost immeasurable. Indeed, I trust that many of our labs today are not what they were a few years ago.

One of the most prominent changes in our field is the move away from the traditional lab manual. I profess that lab manuals have their purpose, but there is a trend for many instructors to construct their own manual so that the course content is better reflected. Indeed, it was shown by Peter Reuter that replacing a general lab manual with a more content-focused manual (Anatomy and Physiology I Course Companion and Lab Workbook) that was designed by him and his lab associates not only increased student scores, but also elevated the scores on the student’s assessment of the course (Reuter 2015a), thereby benefiting both students and faculty. Interestingly, even though student scores increased, they were not required to buy a standard A&P textbook, but were given guidance so that they were able to choose a suitable book (Reuter 2015a).

A more technological approach to building an in-house lab manual was to design an interactive e-manual that could be used on a mobile device (McAndrew 2015). The e-manual (to be used on an Apple device) also contains high quality images and videos (McAndrew 2015). What is quite impressive is that the e-manual can provide targeted and timely feedback on formative assessment tasks (McAndrew 2015). Although students thought the e-manual was beneficial for their learning, they wanted the PDF version of the manual to remain available (McAndrew 2015). Many professors have also adopted smartphone technology to send messages over social media or to use them as clickers (e.g., Socrative, Poll Everywhere) in the classroom. Taking the smartphone technology a bit further, Brianna Julien and colleagues used Attendify (used by the HAPS 2014 annual conference) to post the student guide text directly into the app (Julien 2015). They report a high rate of student buy-in to the app., which should improve student learning (Julien 2015).

Another common transition in the A&P lab is to incorporate virtual and simulation style labs, which is also used to augment lecture material. For example, web-Human (a simulation used for virtual labs) was used to complement traditional didactic lectures in nurse education (Désilets 2015). Désilets and colleagues found that nurses improved their scores during the cardiovascular pathophysiology module using web-Human (Désilets 2015). More complex technology can also be incorporated into the wet-lab. For example, incorporation of a 3-D Dissection table has become more common in some virtual labs, replacing the outdated 2-D static images and models (Lane 2015).

It appears that many A&P instructors are abandoning the traditional lab manuals in favor of producing more technology-based and individualized products and approaches. It is also apparent that students embrace technology, but also like flexibility in the curriculum. From my personal discussions at the HAPS 2015 meeting it was also clear that students could be a bit apprehensive about using technology, especially if they are provided with so much technology that they are overwhelmed.

**Flipping the classroom**

The flipped classroom has become a popular model for course instruction in recent years. In the flipped classroom paradigm, most rote memorization or basic material, such as, power point slides and basic prerequisite information, is provided online as written, virtual or video files. This approach frees up time so that instructors and the students can engage in more active and student-centered learning tasks that delve deeper into specific aspects of the material. To the dismay of many instructors, flipping the classroom can be a challenge because it forces them to restructure the entire course content delivery mode. Therefore, it is typically advisable to start with a few modules as a pilot project before one completely flips the classroom.

Ann Caplea presented an amendable example on how to “ease” into flipping the classroom (Caplea 2015). Prerecorded PowerPoint lectures were used outside of class and students annotated them as homework (Caplea 2015). In the classroom, active learning modules were incorporated where students could work individually or in groups, thus providing more teacher-to-student and student-to-student collaborations (Caplea 2015). Thomas Mikkelson also incorporated video instruction in the teaching of nursing students who were studying kidney and urinary system anatomy and physiology. He found that the students were satisfied with video teaching and thought that this approach encouraged learning (Mikkelson 2015).

Some instructors have been hesitant to flip the classroom because of high course enrollment. Kimberly Fournier has overcome this hurdle and has flipped her classroom of 500 students divided into two sections (Fournier 2015). Here, the author
used two pedagogical approaches 1) she flipped the delivery content to cover foundational material outside of the class, and 2) she implemented a two-stage group exam process (Fournier 2015). Flipping the classroom provided more student self-regulation and independent learning, but success varied depending on the content area (Fournier 2015). For the two-stage test, students completed an individual exam as normal, but then immediately upon completion redid portions of the exam in groups. Using the two-stage method, it was found that students increased content retention (Fournier 2015), which shows that peer teaching has beneficial results in course outcomes. Similar positive outcomes were found using peer teaching in the open lab paradigm (McCarthy 2015). This bold attempt to flip the high-enrollment classroom gives us promise that student number does not restrict the flipped classroom.

Flipping the classroom can also afford instructors to be creative in content delivery. For example, Mia Ray had students create poems that focused on the axial and appendicular skeleton as well as the cell or organelles (Ray 2015). Assessment data showed that students who completed the poem assignment showed increases in both scores and retention of the course content (Ray 2015). Another interesting and physically active exercise (no pun intended) was to use yoga Asanas to teach musculoskeletal anatomy (Loyet 2015). Specific yoga poses were used because students could physically experience the muscle movement and location in their own body (Loyet 2015). Although there was no significant difference between pre- and post-quiz scores for students who either participated or opted out, there was a high degree of enthusiasm for the exercise for those students who participated (Loyet 2015). Importantly, students mentioned that this exercise is something they can “take home” with them and “provides a nice study break without actually stopping studying” (Loyet 2015).

Although flipping the classroom is not a new concept, it is now taking root more than ever before. Indeed, the “sage on the stage” is waning, while the “guide on the side” is growing in prevalence (King 1993). Flipping the classroom frees up class time, providing more instructor/student and student/student interactions. Importantly, moreover, students become independent self-learners.

**Online learning**

Another major shift in content delivery is the move to online learning. Online learning can take many forms, but during the HAPS 2015 poster session online learning was either employed as specific modules or full online courses. For example, online modules can be used to alleviate the minutia of basic chemistry and other basic biology pre-requisite knowledge, particularly at the beginning of A&P courses (Hall-Porter 2015).

Online group discussion forums are also becoming popular. Ni Song used an online group discussion forum to help build teamwork among students (Song 2015). Case studies were given and students used teamwork in small discussion groups to generate a conclusive group answer (Song 2015). Similarly, Marnie Chapman used a specific topic to generate online team discussions. Her students self-sorted into Disease Teams, where each team was given a specific disease (Chapman 2015). Students gained literacy into the interconnectedness of systems by discussing multifaceted process of the disease (e.g., homeostatic loops disrupted by alcoholism, chemicals associated with alcoholism, cellular process disrupted by alcoholism, and alcohol effects on body systems).

Another common theme at the 2015 HAPS conference was the use of social media in the classroom (see Bowen’s Update Seminar VI, 2015). Malynde Weaver, for example, has incorporated a Lab Companion via Facebook to post pictures of laboratory models and video clips, which saves time in the laboratory (Weaver 2015). Importantly, using this social media outlet has provided one solution to the overcrowded lab space due to increased enrollment (Weaver 2015).

As online learning becomes a more common part of our curriculum, whether it is a full online course or blended (part face-to-face and online), we will need to find the most appropriate tools to best engage our students.

**Student self-motivation**

Raise your hand if you have a problem with class attendance. I think we have all struggled with this, but many of us have yet to find a probable solution. Indeed, two posters presented how class attendance, indeed, improves grades earned in the A&P course (Ganguli 2015, Gill 2015). As an incentive to attend class, Mukul Ganguli allocated 50 points (5% of the total grade) to attendance (Ganguli 2015). Significant differences were found between students with grades A through D at 16 weeks (Ganguli 2015). Thus, whether we provide incentives (e.g., bonus points, mandatory attendance, pop quizzes), it is imperative for us as instructors to encourage our students to attend class. Often it is a lack of student self-motivation that results in suboptimal course participation. Ethel Gordon and colleagues presented a poster on how they allow students to volunteer for extra credit at the end of the semester (Gordon 2015). Their reasoning is that student motivation should drive them to better learn the material. They have the students present a research topic related to A&P, which also fosters active learning and student inquiry and research (Gordon 2015).

Another interesting poster showed that when students were asked to estimate their exam scores, the majority would overestimate (Reuter 2015b). Interestingly, students that developed a better understanding of what they knew were better able to estimate their exam scores, and these students did better on the final exam (Reuter 2015b).

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It is apparent that students inherently need to do a better job investing in their course work. Lack of self-motivation is a common and ongoing problem and these posters give insight into some ideas that we can use to increase student attendance and motivation. It would be particularly useful to show the students the data! For example, at the beginning of the semester, showing students correlational data linking student attendance with success rates may convince them of the benefits to be gained from coming to class regularly.

Discussion
The goal of this review was to give all HAPS members a brief overview of selected posters presented at the 2015 Annual Conference that focused on engaging A&P students both in and out of the classroom and laboratory. Because A&P is often a "gateway course" to upper division science courses, it is important for faculty to sow the enthusiastic scientific seed in our students so they become engaged. Importantly, what is most evident in the pedagogical agendas and strategies that were presented is that we have to ensure that our students become self-learners.

It is worth noting that the pedagogical efforts presented here are in line with the National Research Council (NRC) 2007 and the Vision and Change in Undergraduate Biology Education: A Call to Action (AAAS 2009), which emphasizes that the HAPS faculty members are pushing forward to help prepare the next generation of STEM students. It is also worth noting that active learning does work (Michael 2006), and we should be incorporating more of it into our curriculum.

A last comment is that a major challenge that most of us face, and a common lament among faculty, is that students lack GRIT (Cohen 2015, Duckworth 2013). Essentially, grit is the self-motivation, determination, passion, and willingness to achieve long-term goals.

I look forward to exploring how we can teach our students to have grit, which may enhance student academic performance.

I want to end by saying that I am extremely grateful to those authors that gave me access to their posters for review; thank you. Because of the limited scope of this review, I apologize for all the great posters that were not represented herein.

About the Author

Benjamin Miller, Ph.D., is an Assistant Professor of Biology at Texas Wesleyan University where he teaches all the Human Anatomy and Physiology lectures and labs. He received his Ph.D. in Neuroscience and Psychology at Indiana University. His postdoctoral position was at UT Southwestern Medical Center. His research centers on the neurophysiology of neurodegeneration. His current focus is to use the flatworm planaria as a model to explore the neurobehavioral effects of neurotoxicity. The ultimate goal is to discover drugs that ameliorate neuron dysfunction driven by glutamate excitotoxicity.

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Miller, BR. (2012). Against all authority, researching controversial topics in the Human Anatomy and Physiology classroom, Poster 22, HAPS Annual Conference, Tulsa, OK.

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Instructor’s Liability for Student Injuries in the Lab: 
Are We Covered?  A Report by the Human Anatomy and Physiology Society (HAPS) Safety Committee

Yuli Kainer1 and Neal Dean Schmidt2

Co-authors: Alicia Anderson3, William Jones4, Karen McMahon5, Joseph Olubadewo6, Bill Perrotti7, Richard Simons8, Mary Vagula9, Daniel Williams10, Glen Yoshida11

1San Jacinto College North, 2Pittsburg State University, 3Columbus Technical College, 4Upper Iowa University, 5University of Tulsa, 6Southern University of New Orleans, 7Mohawk Valley Community College, 8Schenectady County Community College, 9Gannon University, 10University of Saint Mary, 11Los Angeles Southwest College

** Yuli Kainer and Neal Dean Schmidt presented a poster on this topic at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.

Introduction

A methanol fire in a chemistry lab at Denver’s Science, Math, and Arts Academy, reported by Associated Press and published in the Tulsa World (2014), inspired a discussion among the HAPS Safety Committee and List-Serv about hazardous chemicals in the Anatomy and Physiology (A&P) laboratory. The Occupational Safety and Health Administration (OSHA) requires school districts to train and supervise educators who handle hazardous chemicals, but many educators do not receive training. Groups, such as the National Science Teachers Association (NSTA), offer training and online assistance and the Human Anatomy and Physiology Society (HAPS) has developed Safety Guidelines that cover these issues specific to the Human A&P Laboratory.

In the incident reported, a chemistry teacher, performing a demonstration with methanol, produced an uncontrolled methanol fire, which injured the faculty member and several students, one seriously. On the HAPS List-YuliServ a discussion evolved about liability issues and some HAPS members reported that they were required to purchase their own liability insurance; others thought they were covered by their institution in case of injuries in the lab. This discussion led to the Safety Committee’s creation of a Safety Survey that was posted on the HAPS website to determine more about liability issues if students were to be injured in the Human A&P laboratory and the method of liability coverage for potential injuries. The survey was available through the HAPS website from March 09-17, 2015 and some HAPS members were able to complete the survey through the HAPS List-Serv.

Results

Distribution of Participants

A total of fifty-six faculty members participated in this survey. The survey participants’ institutions were located in two countries, the United States and Canada. The majority of the participants were located in the US (94.64%) and only 5.35% of the participants were from Canada. See Figure 1 for country of emplacement of the participants’ institutions.

HAPS has divided the membership into four geographical regions, the boundaries of which are approved by the Board of Directors (HAPS website). See the map of regional organization of HAPS (image from http://www.hapsweb.org/resource/resmgr/Images/HAPSregions.jpg ) (Figure 2).

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Based on the approved regional distribution of members, the survey revealed that participants were found to originate from all four of the geographical regions as defined by HAPS (Figure 3).

Additional analysis of the survey data revealed that 53.57% of the participants were from 2-year colleges and only 3.57% of the participants were from technical schools. Participants that taught at a 4-year college constituted about 42.86% of the total population (Figure 4).

**Awareness of Liability Coverage**

The majority of the participants (76.78%) were aware of the existence of some type of liability coverage regardless of the participants having coverage or not (Figure 5).

Less than 25% were not aware of the existence of liability coverage.

**Types of Liability Coverage** (Figure 6)

The types of professional liability coverage possessed by survey participants included various group policies and individual policies, with most receiving some type of group coverage and far fewer purchasing an individual policy. Group liability insurance provided by the institution was the most common type of coverage (46.42%). The remainder of participants that had coverage reported that they had group-union, state, or individual policies. Very few participants purchased their own individual liability policies (3.57%) or purchased group coverage through their union (5.35%).

Three and a half percent of participants reported that they had state-provided liability coverage and 8.2% of participants reported that their state law provided immunity for instructors from liability for student injuries that occur in lab. The remaining participants (41.07%) did not have individual policies and either (i) did not know if their institution provided group coverage or (ii) had some other arrangement.

**Distribution of Liability Coverage**

Based upon the responses from individuals who knew how their liability protection is provided (39/56) the most common method was institution liability coverage from the workplace (46.42%). The next most common methods were: (i) that the state or province specifically prevented lawsuits from being filed against the instructor (8.92%) or (ii) the institution encouraged the instructor to provide their own protection (8.92%). Other methods of reported liability coverage were: (i) the state or province provided the protection (3.57%), (ii) the instructor’s union provided

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**Figure 3**

Regional Distribution of the Survey Participants within the USA

**Figure 4**

Institution Type of the Survey Participants

**Figure 5**

Awareness of Liability Coverage

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</thead>
<tbody>
<tr>
<td>Aware of Liability Coverage</td>
<td>76.78%</td>
</tr>
<tr>
<td>Not aware of Having Liability Coverage</td>
<td>23.22%</td>
</tr>
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**Figure 6**

Types of Liability Coverage

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<tr>
<th>Types of Liability Coverage</th>
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<tr>
<td>Provided by the Institution</td>
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</tr>
<tr>
<td>Provided by the State</td>
<td>3.57%</td>
</tr>
<tr>
<td>Provided by the Instructors Themselves</td>
<td>3.57%</td>
</tr>
<tr>
<td>Provided by an Union</td>
<td>5.35%</td>
</tr>
<tr>
<td>Unknown/Other</td>
<td>41.07%</td>
</tr>
</tbody>
</table>
the protection, 5.35% or (iii) the instructor provided the protection (3.57%). In approximately 30% of the responses, the instructor reported that he or she did not know how their liability coverage was provided or were not aware that they had liability coverage (Figure 7).

**Trends of Liability Coverage by Region**

According to the obtained data, it was noted that in the Central and Western regions, more than 60% of the participants reported that liability coverage was provided by their institution. In contrast, in the Southern region, the participants reported that the institution provided liability coverage less than 30% of the time. In the Southern region, 42.86% of the participants reported that their institution encouraged instructors to obtain their own liability coverage; in the Eastern region, only 10% of the participants fell into this category. In the Western and Eastern regions, a small percentage of participants (6.25% and 7.69% respectively) reported that liability coverage was provided by their union; there was no mention of a union in the Southern or Central regions. Over 46.15% of the Eastern region participants were not aware of any type of liability coverage (Figure 8).

**Conclusion**

There appears to be considerable variability regarding options in liability coverage for potential injuries incurred in the A&P laboratory, with variations even within the same state. In some areas, the instructors are not liable for student injuries, however, that does not mean that the instructors are not to follow all the safety guidelines to protect themselves and their students from injury in the laboratory. It is recommended that instructors inquire at their institution about liability coverage and proceed accordingly. In some instances, the instructor may need to obtain his or her own liability coverage. We should always strive to maintain the highest level of safety in the laboratory regardless of the type, extent, or knowledge of covered entities. The Human Anatomy and Physiology Laboratory Safety Guidelines are available at [http://www.hapsweb.org/?page=Safety_home](http://www.hapsweb.org/?page=Safety_home).
Reference cited:

About the Authors (Co-Chairs)

Yuli Kainer received her MD from the Universidad de Carabobo in Venezuela in 1991. She completed a Master’s Degree in Biology at the University of Houston, Clear Lake, in 2007. Dr. Kainer joined the faculty of at San Jacinto College North in Houston in 2005 where she currently teaches Anatomy and Physiology I and II and Pathophysiology.

Neal Schmidt is a clinical pharmacist and an instructor in the areas of Anatomy and Physiology, Immunology, and Pathophysiology at Pittsburg State University in Pittsburg, KS. As a clinical pharmacist, he is employed by Dillons Pharmacy providing Medication Management Therapy. In this capacity, he works under collaborative drug therapy management protocols to care for primary and secondary prevention patients in an outpatient setting in Southeast Kansas. In the course of his work he addresses modifiable risk factors including hyperlipidemia, hypertension and smoking, and ensures that evidence based therapies such as anticoagulants, antiplatelets, ACEIs, ARBs and beta blockers are optimized.

2016 Conference Candids
**Pre-Lecture Reviews with Anatomy Tunes**

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Abstract

We propose an exercise, conducted approximately fifteen minutes before lecture, designed to engage students, review material, and introduce new topics. This activity serves to incentivize student attendance and encourage early arrival. This exercise consists of playing an unguided power point presentation; the slides loop and change automatically, which reviews the material from the previous lecture. Additionally, popular music is played with themes consistent to introduce the new lecture. Anonymous surveys show students find the exercise useful and effective. This workshop details our pre-lecture review protocol and provides anatomy related music. Sit back and watch as students discuss and cooperate to answer your review questions.

**Anthony Weinhaus and Jason Massey presented a workshop on this topic at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.**

Introduction

At the HAPS Annual Conference in 2013, Mark Nielsen from the University of Utah presented a workshop on teaching the cervical fasciae. Before his workshop, as the attendees were getting seated, Mark played an automated PowerPoint presentation. It was a series of quick quizzes in anatomy. In further discussions of this type of quiz, we agreed that this reminded us of a movie theater trivia show that plays before the feature presentation. Mark Nielsen further explained that he frequently presents similar quizzes before his lectures in his Human Anatomy course. He observed that the students were engaged with his quizzes and they seemed to help his students study for their exams.

We were very interested in this idea and began implementing it before our lectures at the University of Minnesota in our Principles of Human Anatomy course. We found immediately that the reactions of our students were similar to those observed by Mark Nielsen in his course. We have since produced a pre-lecture quiz for each of our lectures and collected data on students’ perceptions of these activities. We recently presented our findings at the 2015 HAPS Annual Conference in San Antonio, Texas. We feel our workshop went very well and was well received. We were encouraged to submit our description of the workshop to the HAPS EDucator.

Pre-Lecture Reviews

This exercise takes place in the 15 or so minutes before lecture begins. As students enter the lecture hall, a fully automated slide show quiz is playing. Think of movie theater-style trivia that plays before the coming attractions and feature presentation. This quiz is not worth any points and is designed to engage students with the material before lecture even begins. Furthermore, since our class is early in the morning, this helps to wake students up and prepare them for lecture. As the Pre-Lecture Review is being played, the instructor has time to get prepared and set-up for the lecture. This is beneficial to the instructor, especially those who may work in older classrooms, where longer set-up times may inevitably be required as a result of having older computers, increased likelihood of equipment malfunctioning, etc.

When we began running the pre-lecture slide shows, we immediately noticed increased student engagement and participation. Students would look at the screen; answer the questions; begin talking, discussing, and defending their answers with their peers; all before lecture even began! As anatomy and physiology requires students to learn a lot of new information, this exercise encourages them to review these new terms. Other benefits we noticed were that the pre-lecture review provokes questions, shows students their areas of weakness, develops student peer interactions, and provides students with a method and model of studying. It also provides a constant reminder to study and can show students their areas of weakness without embarrassment.

All of this has the potential to help students prepare for exams. Further, since the presentation is shown before lecture, it encourages students to arrive early, decreasing the number of distractions from late arrivals. The review questions might also provoke students to ask questions in the upcoming lecture.

Over two consecutive years we have provided a voluntary, anonymous survey to our students in regard to the pre-lecture reviews (Figure 1 a-c). Overwhelmingly, our students agreed or strongly agreed that the pre-lecture reviews were useful, a good use of time, and an effective learning tool.

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A pre-lecture slide show can be made in about 15-20 minutes. The review consists of a collection of questions, each a series of three slides: the question, a hint or clue, and an answer. Each slide simply consists of copying and pasting materials from a previous lecture. For example, one might choose a figure that was discussed and remove all tags and labels. Add this figure to a Powerpoint slide and write a question. The question can consist of anything, for example, “identify the structure” or “what is the function or pathway involved?” The next slide should be a clue. Near the question, provide some information about the structure. For example, provide the etymology (if it was discussed in class), the physiology or function, the structure(s) found near, through, superior or medial to the structure, or a description of the structure’s blood supply and nerve innervations. Finally, the last slide in the three-slide series should be the answer.

After doing this several times to build many slides, set the slideshow to advance automatically and to loop repeatedly. We have learned from experience a few details that will make the presentation most effective:

1. Build about 10 questions or 30 slides into the loop
2. Set the slides to change automatically every 8 seconds. If the slide show advances too slowly, students get bored and lose interest; too quickly, and they give up.
3. Importantly, since repetition is the key to learning, the slide show should loop at least two or three times before the start of the lecture. Note that students present at the beginning have many opportunities to answer and review questions but students who walk in a bit later can still see many of the slides.

Finally, this type of presentation can also be used after an exam, prior to starting new lectures. The presentation can review information from the recent exam and can also introduce new material. For example, we begin our class with Histology, including epithelia. After the exam on Histology, but before we begin lectures on the digestive system, the presentation might contain quiz questions on stratified squamous and simple cuboidal epithelia. These quiz questions will, of course, correlate with the material in a subsequent lecture on the two primary epithelia of the gastrointestinal tract. Similarly, a presentation before the urinary system might include quiz questions on transitional epithelium.

Additionally, everyone knows something about human anatomy! Before the very first class, a pre-lecture quiz might consist of structures that students are likely to already know, or will soon know. For instance, the first quiz might include certain bones, skin, digestive organs, heart and lungs. This can be a great way to introduce students to the course!
Anatomy Tunes

During the pre-lecture review slide show, we also play songs designed to introduce the new lecture material. Thus, the pre-lecture slideshow reviews the previous lecture’s material, while the songs give clues on what that day’s lecture will be. Most of the songs come from popular radio music and are not meant to be obscure. Students should know the lyrics and enjoy them. When a song is a bit obscure it should be funny and entertaining such as “I Love My Pancreas” by Weird Al Yankovic or “Colo-Rectal Surgeon” by Bowser and Blue.

Very few of our songs come from the instructors; our songs are largely provided by our students. We tell the students throughout the course that previous anatomy students brought these songs to our attention. This encourages the students to send us song ideas to play in class. Thus, the students have contributed to the course and this, in turn, encourages future engagement.

There are a variety of platforms that can be used to play these songs. Embedding songs in PowerPoint can allow a bit more control on which slides play a certain song. However, we find that it is easier to play songs from iTunes or Spotify. Spotify, unlike other websites, is free of charge and free of advertisements, so long as you are not playing directly from the online radio. It can also be used, like iTunes, to choose songs and make a playlist. The downfall of Spotify, and other web-players, is that if your Internet connection is poor, you have no songs to play!

Again, through our anonymous polls (Figure 1d), students overwhelmingly support our use of Anatomy Tunes. Embedding songs in class is a great tool to help students engage and stay interested. Playing just one or two songs over and over again, leads to frustrated students!

Conclusions

Pre-lecture Reviews and Anatomy Tunes can be done with both a systems-based or region-based anatomy and physiology course. We believe this is a positive learning tool for our students, and they seem to appreciate our efforts to help them learn. Table 1 provides a list of our current Anatomy Tunes by system.

Please feel free to contribute to our list of Anatomy Tunes (notice we have a lack of urinary related music, for seemingly obvious reasons…) and e-mail us to receive our updated lists!

About the Authors

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Dr. Weinhaus is an Assistant Professor in the Department of Integrated Biology and Physiology at the University of Minnesota. He is the Director of the Program in Human Anatomy Education. Dr. Weinhaus received his Ph.D. in Cellular Physiology from the University of Sydney, Australia and did post-doctoral training in the Department of Genetics, Cell Biology and Genetics at the University of Minnesota.

Dr. Weinhaus’ current research involves a varied number of projects in Gross Anatomy. These include Anatomic variations, dissection protocols, examination of student learning in the anatomy laboratory, and tools to facilitate the teaching of anatomy - including the production of plastinated teaching specimens.

Jason S. Massey

Jason Massey is a PhD candidate in the Department of Anthropology at the University of Minnesota. He is also a teaching assistant in the Program in Human Anatomy Education in the Department of Integrative Biology and Physiology, University of Minnesota Medical School. He received his Master of Arts in Anthropology at the University of Minnesota and his Bachelor of Science in Anthropology at Baylor University. Through his appointments in anatomy and anthropology, he teaches human anatomy and primate evolutionary anatomy at both undergraduate and professional levels. Jason’s interests are in primate growth and development, skeletal analysis of chimpanzees and gorillas, and human evolution. His specialties include osteology, geometric morphometric statistical analyses, and three-dimensional surface scanning.

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Links:
The following are links to the HAPS 2015 workshop entitled “Pre-Lecture Reviews with Anatomy Tunes” and our compilation of anatomy-related music (by systems).

https://db.tt/HLwmOohf or https://drive.google.com/a/umn.edu/file/d/0B5yLNHSmgDpcRTRIOG5jbXE1ODQ/view?usp=sharing
https://db.tt/QdRU4x3W or https://drive.google.com/a/umn.edu/file/d/0B5yLNHSmgDpcRVpCYWN4WXRsaDg/view?usp=sharing

Acknowledgments
We would like to thank the Department of Integrative Biology and Physiology, the Program in Human Anatomy Education, at the University of Minnesota Medical School and the Department of Anthropology at the University of Minnesota, Twin Cities, for the funding in order to attend the annual HAPS conference in 2015. We would also like to thank our Principles of Human Anatomy students at the University of Minnesota from 2014 and 2015 for contributing to our voluntary, anonymous surveys.

Anatomy Tunes for Human Anatomy Lectures by Lecture Topic

<table>
<thead>
<tr>
<th>Course Orientation</th>
<th>Cardiovascular system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help I’m alive - Metric</td>
<td>Bad Blood – Taylor Swift</td>
</tr>
<tr>
<td>I’ve got you under my skin - Sinatra with Bono</td>
<td>Be still my beating heart - Sting</td>
</tr>
<tr>
<td>Pieces of me - Ashlee Simpson</td>
<td>Bleeding love – Leona Lewis</td>
</tr>
<tr>
<td>Rock your body – Justin Timberlake</td>
<td>Blood and roses - the Smitherines</td>
</tr>
<tr>
<td>Scrubin’ - MedSchoolRocks</td>
<td>Blood that moves the body -AhA</td>
</tr>
<tr>
<td>The Gunner - Harvard Medical School</td>
<td>Cold cold heart - Nora Jones</td>
</tr>
<tr>
<td>Your body is a wonderland - John Mayer</td>
<td>Don’t funk with my heart — Black Eyed Peas</td>
</tr>
<tr>
<td>Histology</td>
<td>Don’t waste your heart - Dixi Chicks</td>
</tr>
<tr>
<td>Barbershop Histology - unknown</td>
<td>Fortress around my heart - Sting</td>
</tr>
<tr>
<td>Skeletal system</td>
<td>Give Your Heart a break – Demi Lovato</td>
</tr>
<tr>
<td>Hole in my head - Dixie Chicks</td>
<td>Heart Attack – Demi Lovato</td>
</tr>
<tr>
<td>In the Valley of Dry bones – Cathedrals Quartet</td>
<td>Pump your blood song – Bloodbook.com</td>
</tr>
<tr>
<td>Lazybones - Harry Connick</td>
<td>Hello Mr. Heartache - Dixi Chicks</td>
</tr>
<tr>
<td>Shake that lower limb – MedSchoolRocks</td>
<td>I Left My Heart In San Francisco - Tony Bennet</td>
</tr>
<tr>
<td>Skin and bones – Foo Fighters</td>
<td>Listen to her heart - Tom Petty</td>
</tr>
<tr>
<td>The Pelvis Ho-down - MedSchoolRocks</td>
<td>My Heart belongs to daddy – Marilyn Monroe</td>
</tr>
<tr>
<td>Them bones/Dry Bones (Dem Bones) – sing along songs</td>
<td>My Heart Goes Boom- French Affair</td>
</tr>
<tr>
<td>Muscular system</td>
<td>My heart is beats like a drum - DamDamDam</td>
</tr>
<tr>
<td>Baby Got Back – Sir Mix Alot</td>
<td>Pumpin’ Blood - NoNoNo</td>
</tr>
<tr>
<td>Bootlissious - Destiny’s child</td>
<td>Pumps your blood song - Abner Stinqort</td>
</tr>
<tr>
<td>Legs – ZZ Top</td>
<td>Rush of blood to the head – Cold play</td>
</tr>
<tr>
<td>Nervous system</td>
<td>Shape of my Heart - Sting</td>
</tr>
<tr>
<td>Brain damage – Eminem</td>
<td>Sunday, Bloody Sunday - U2</td>
</tr>
<tr>
<td>Cranial nerves are sexy - MedSchoolRocks</td>
<td>With a song in my heart -- Jose Carreras</td>
</tr>
<tr>
<td>Eponymrods – MedSchoolRocks</td>
<td>Respiratory system</td>
</tr>
<tr>
<td></td>
<td>Every breath you take – Sting</td>
</tr>
<tr>
<td></td>
<td>Highway to the Danger Zone - Kenny Loggins, Top Gun Soundtrack</td>
</tr>
<tr>
<td></td>
<td>No air - Jordan Sparks</td>
</tr>
<tr>
<td></td>
<td>Take my breath away - Berlin</td>
</tr>
<tr>
<td></td>
<td>Take my breath away - Jessica Simpson</td>
</tr>
<tr>
<td>Digestive system</td>
<td>Colo-rectal Surgeon – Bowser and Blue</td>
</tr>
<tr>
<td></td>
<td>Heart burn - Alicia Keys</td>
</tr>
<tr>
<td></td>
<td>Pancreas (I love my pancreas) — Weird Al Yankovic</td>
</tr>
<tr>
<td>Lymphatic system</td>
<td>Fever (You give me fever) -Peggy Lee</td>
</tr>
<tr>
<td></td>
<td>What does the spleen do ? – Harvard Medical school</td>
</tr>
<tr>
<td>Endocrine system</td>
<td>Bought the Pharm - MedSchoolRocks</td>
</tr>
<tr>
<td></td>
<td>Golgi apparatus - Phish</td>
</tr>
<tr>
<td>Urinary system</td>
<td>Gotta go – Trey Songz</td>
</tr>
<tr>
<td></td>
<td>Wake me up before you go go – Wham!</td>
</tr>
<tr>
<td>Reproductive system</td>
<td>My baby baby baby girl - MedSchoolRocks</td>
</tr>
</tbody>
</table>
Teaching Cardiopulmonary Physiology to Upper Level Undergraduate Students with Clinical Correlation Using Human Patient Simulators

Mary C. Vagula¹, He Liu¹ and Michael McCarthy²

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²Patient Simulation Center, Gannon University, Erie, Pennsylvania

Abstract

The use of patient simulators is becoming common in medicine and health care education. In this study an attempt was made to evaluate the effectiveness of patient simulators in enhancing student understanding of normal cardiopulmonary physiology and the parameters used in the diagnosis of associated disease states. Sixty-seven students participated in this study. Students measured various cardiovascular parameters, identified the deviations from normal functions and diagnosed the simulated conditions using four adult patient simulators and an infant simulator. Students also took pre-lab and post-lab quizzes and completed a feedback questionnaire. The conditions simulated were: second degree AV block, atrial fibrillation with hypertension, chronic obstructive pulmonary disease (COPD), and aortic stenosis. The average quiz scores following the lab activity improved significantly from 52.2% (pre-test) to 72.8% (post-test) along with an increase in student confidence levels, which increased from a ‘little familiar’ to ‘familiar’ on the rating scale. There was an increase in student performance on questions related to the physiology and pathophysiology of the cardiovascular system from 48% (pre-test) to 65.9% (post-test) and in questions related to the respiratory system from 75.4% (pre-test) to 96.3% (post-test). These results clearly indicate that patient simulators can be used effectively in teaching and reinforcing cardiopulmonary concepts in an undergraduate foundational science course such as physiology.

** Mary Vagula and He Liu presented a poster on this topic at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.

Introduction

Students retain the subject material for longer periods when they are involved actively in the learning process (Hake 1998, Hoellwarth and Moelter 2011). “Problem based learning” is an active learning method in which students are presented with challenges or puzzles, access prior knowledge, and make connections between old and new concepts. As a result, students learn to think critically (Schmidt et al. 2011) and to synthesize material in order to develop solutions to the problems.

Human patient simulators are specifically used in the education and training of physicians, physician assistants, nurses, and other healthcare professionals. Currently their use in healthcare education is common in the USA and throughout the world. Patient simulators are excellent teaching tools for training in clinical procedures, assessing clinical competency (Grenvik et al. 2004, Naik and Brien 2013) and providing students with opportunities to make critical decisions in life-like situations. Although, they are used in medical education, the use of patient simulators in undergraduate courses, such as physiology, has not been widely reported (Waite et al. 2013).

In view of the rigors of training that biology and pre-health students go through before they enter their field of interest, we thought it would be beneficial to introduce undergraduate students to “problem based learning” of cardiopulmonary physiology using patient simulators. We also felt that the use of patient simulators would illustrate the clinical relevance of this basic science. Furthermore, we have observed that our students’ curiosity for learning physiology and their involvement in classroom discussions increased significantly when physiology was presented from a clinical perspective. As per the recommendations (2009) of the National Science Foundation (NSF) and the American Association for the Advancement of Science (AAAS) for “Vision and Change in Undergraduate Biology Education”, in order for students to be current in the field, they need to have experience with modeling and simulation which leads to analysis and discovery (Bauerie et al. 2009). We designed this lab to provide these opportunities for our students.

In this lab students, working in groups of three, measured and recorded the vital signs and other physiological parameters presented on five patient simulators representing five different clinical conditions and/or diseases. The students were directed to discuss, interpret, and diagnose the conditions that were simulated. In addition, they completed a pre-lab quiz, a post lab quiz and a student feedback questionnaire.

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This lab activity is designed to help us achieve two of the learning objectives for this laboratory course: i) to describe the functions of the cardiovascular and pulmonary systems and ii) to apply the knowledge of physiology to understand disease processes. The Institutional Review Board of Gannon University approved this study and the publishing of subsequent student data, IRB #14-11-03.

Materials and Methods

Sixty-seven students who registered for the physiology laboratory course participated in this study. Four high to medium-fidelity adult patient simulators (Laerdal Company) were used for this study. Four clinical conditions were simulated; second degree AV block, atrial fibrillation with hypertension, COPD, and aortic stenosis. A fifth simulator, “SIM Baby”, simulated a healthy six-month old infant. Table 1 shows the vital parameters programmed in these patient simulators. Students who participated in this lab were familiar with measuring blood pressure, ECG, respiration rate and pulse rate. They were informed of the vital signs displayed on the bedside monitors of the simulators. The displayed vital signs included an ECG tracing, EtCO2, SpO2, respiration rate and pulse rate. Blood pressure was intentionally not displayed on the monitors in order to allow students to measure blood pressure using the traditional method with a sphygmomanometer and a stethoscope. On the day of the lab, before simulation activities, a pre-simulation lab quiz was administered to students. It contained ten questions pertaining to cardiovascular and pulmonary physiology and pathophysiology. Following the quiz students were shown videos on abnormal heart and lung sounds so they could become familiar with some of the abnormal sounds. Students formed into groups of three and moved to patient simulation stations for measuring and diagnosis of the simulated conditions. After assessing and interpreting the observations on the simulators, students were given a post-simulation lab quiz consisting of the same ten questions. The difference in student performance on these quizzes was assessed. Lastly, students provided their feedback on this lab activity by completing a questionnaire.

Table 1. Simulated physiological parameters in the patient simulators

<table>
<thead>
<tr>
<th>Condition simulated</th>
<th>Patient #1</th>
<th>Patient #2</th>
<th>Patient #3</th>
<th>Patient #4</th>
<th>Infant SIM baby</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG</td>
<td>normal</td>
<td>normal</td>
<td>P waves: QRS complexes -2:1</td>
<td>atrial fibrillation</td>
<td>normal</td>
</tr>
<tr>
<td>Heart Sound</td>
<td>Aortic stenosis heart sounds</td>
<td>normal</td>
<td>normal</td>
<td>normal</td>
<td>normal</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>89</td>
<td>102</td>
<td>50</td>
<td>86</td>
<td>120</td>
</tr>
<tr>
<td>Blood Pressure (mm/Hg)</td>
<td>112/78</td>
<td>135/85</td>
<td>102/58</td>
<td>170/106</td>
<td>90/60</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>32</td>
<td>26</td>
<td>28</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>Lung Sounds</td>
<td>normal</td>
<td>wheezing and productive cough</td>
<td>normal</td>
<td>normal</td>
<td>normal</td>
</tr>
<tr>
<td>EtCO2</td>
<td>40mmHg</td>
<td>47mmHg</td>
<td>45mmHg</td>
<td>35mmHg</td>
<td>37mmHg</td>
</tr>
<tr>
<td>O₂ Saturation</td>
<td>93% on O₂ via nasal cannula</td>
<td>87%</td>
<td>85%</td>
<td>98%</td>
<td>98%</td>
</tr>
</tbody>
</table>

continued on next page
Figure 1. A high fidelity patient simulator in the simulated patient ward.

Figure 2. Simulator monitor displaying ECG, pulse rate, heart rate, SpO2, end-tidal carbon dioxide(EtCO2), and respiration rate of a six month old baby. Blood pressure values are intentionally not displayed in order to allow students to measure it manually.

Figure 3. Students working on the patient simulators.
Learning objective assessments

This lab is designed to achieve two learning objectives: i) students describe the functions of the cardiovascular and respiratory systems and ii) students apply knowledge of physiology to understand disease process. Achievement of these learning objectives is assessed using pre-lab and post-lab quiz grades and a questionnaire. The student questionnaire had ten questions that inquired about the effectiveness of this lab activity in enhancing their learning experience, their knowledge level after the lab, and their familiarity with the pathophysiology of the cardiopulmonary system. Most of these questions had five-choice answers: “Not at all (none)”, “A little bit”, “Some”, “A lot”, and “Definitely a lot”. For quantitative analysis, the answers were weighted with a 5-point scale with 1 being “none” and 5 being “definitely a lot”.

Results

A large percentage of students (94%) rated the patient simulator as a better tool for teaching physiology than the traditional tools and/or methods (Figure 10). Eighty-nine percent of the students indicated that patient simulators are valuable in enhancing their learning experiences (Figure 9). The overall rating on the degree of student familiarity with the physiology and pathophysiology of the cardiovascular and respiratory systems increased significantly (64%) after the simulation lab activity (Figures 7 and 8). The students’ overall scores improved significantly from 52.8% in the pre-lab quiz to 72.8% in post-lab quiz (Figure 4). Scores on questions related to the pathophysiology of the cardiovascular system increased from 48% (pre-test) to 65.9% (post-test) (Figure 5). Scores on questions related to the pathophysiology of the respiratory system also improved significantly from 75.4% (pre-test) to 96.3% Post-test (Figure 6).

In their questionnaire, a majority of students’ wrote that this lab offered them a life-like clinical experience that made them think critically in a manner similar to the way real healthcare professionals handle situations in a hospital. Many students liked this activity stating that it gave them an opportunity to recollect their prior normal physiology knowledge and apply that knowledge to make a diagnosis. In the authors’ course evaluations and in the laboratory questionnaire students indicated that they enjoyed this lab activity and many students requested that more patient simulator labs be included in the course.

Discussion

The design and implementation of this new patient simulator lab activity for teaching physiology proved to be highly successful and was welcomed by the undergraduate students (Figure 10). The results of this study clearly indicate that simulated lab activity drew overwhelmingly positive response from the upper level undergraduate students. In this lab the patient simulators were used to simulate several disease conditions and students had to diagnose the simulated diseases using their prior knowledge of physiology. The method we used was essentially “problem-based learning” and the learning process was thus student-centered-active learning. The students’ knowledge of the physiology and pathophysiology of the cardiopulmonary system increased significantly from 52.8% (pre-test) to 72.8% (post-test) in a very short period of time (Figure 4-6). It is evident from their comments on the student questionnaire and in the course evaluations that they not only learned the subject matter (Figure 4) but also enjoyed this investigative activity. Our observation of student involvement, enthusiasm, and performance in this study is in agreement with other reports (Schraw and Lehman 2001, Hidi and Renninger 2006, Litman 2008) on an increase in situational interest (an immediate affective response to certain environmental stimuli in the learning environment that focuses one’s attention on the task) and epistemic curiosity in students who are presented with puzzles, novel questions, and challenging tasks (Rotgans and Schmidt 2012). Results of this report indicate that this lab activity instilled critical thinking skills, enabled students to recollect prior knowledge and to apply and synthesize the information to come up with solutions and/or diagnoses.

It is observed through this activity that vast majority (94%) of the students liked patient simulators over traditional tools and/or methods and rated them very highly as tools that greatly enhanced their learning experiences. Compared to the pre-lab quiz the students’ average percentage score in the post-lab quiz increased significantly, from 52.8% (pre-test) to 72.8% (post-test) (Figure 3), which is hard evidence that the learning objectives are met. Students’ average scores in cardiovascular and respiratory diseases also increased significantly (Figures 4 and 9). Student comments on the questionnaire indicated that the patient simulation exercise provided them hands-on, life-like clinical scenarios where they were able to apply their cardiopulmonary knowledge by discussing and working in a team.

Students also answered questions about their familiarity of the subject matter, with five choices from “very unfamiliar” to “very familiar”, before and after the lab (Figures 5 and 6). The percentage of students who said ‘unfamiliar to a little familiar’ before the lab was 72% and after the lab activity it diminished to 8% while those who said ‘familiar to very familiar’ on pathophysiology rose from 4% to 64% after the lab. Overall the data obtained through this study strongly indicate that problem-based learning via patient simulators can be used effectively in teaching a basic science course such as physiology.

Many students appreciated the value and effectiveness of this hands-on activity (Figures 7 and 8) so much that they asked for more labs to be designed with patient simulators. The method we used was essentially “problem-based learning” and the learning process was thus student-centered-active learning. The students’ knowledge of the physiology and pathophysiology of the cardiopulmonary system increased significantly from 52.8% (pre-test) to 72.8% (post-test) in a very short period of time (Figure 4-6). It is evident from their comments on the student questionnaire and in the course evaluations that they not only learned the subject matter (Figure 4) but also enjoyed this investigative activity. Our observation of student involvement, enthusiasm, and performance in this study is in agreement with other reports (Schraw and Lehman 2001, Hidi and Renninger 2006, Litman 2008) on an increase in situational interest (an immediate affective response to certain environmental stimuli in the learning environment that focuses one’s attention on the task) and epistemic curiosity in students who are presented with puzzles, novel questions, and challenging tasks (Rotgans and Schmidt 2012). Results of this report indicate that this lab activity instilled critical thinking skills, enabled students to recollect prior knowledge and to apply and synthesize the information to come up with solutions and/or diagnoses.

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Figure 4. Students’ scores in pre and post-simulation lab quizzes. Values are average percentage score with ± SE.

Figure 5. Students’ performance in cardiovascular disease questions. Values are average percentage score with ± SE.

Figure 6. Students’ performance in respiratory system disease questions. Values are average percentage score with ± SE.
Figure 7. Students’ self-assessment of familiarity of the cardiopulmonary pathology before patient simulation lab (compare this to Figure 8)

Figure 8. Students’ self-assessment of familiarity of the cardiopulmonary pathology after patient simulation lab

Figure 9. Patient simulators as valuable tools in enhancing learning cardiopulmonary physiology and pathophysiology

Figure 10. Student perception on the effectiveness of patient simulators in teaching cardiovascular and respiratory physiology

continued on next page
simulators. The authors plan to introduce another new lab activity with patient simulators in the future.

**Acknowledgements**

We thank all our students who participated in this study. We want to thank Dr. Sarah Ewing, Chair of the Biology Department and Dr. Steve Mauro, Dean of the Morosky College of Health Professions and Sciences, for supporting us in the development of this lab. We would also like to thank the Institutional Review Board of Gannon University for permitting us to conduct this study. We also want to thank Gannon University for awarding faculty development grants.

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*He Liu, Ph.D.*, is an assistant professor of biology at Gannon University. His research focuses on the molecular basis of animal physiology and behavior.

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**Literature cited:**


Using a Background Knowledge Probe to Assess Student Preparedness for a Physical Therapy Program Human Anatomy Course

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Abstract
Anatomy and physiology are prerequisites courses for the Western Carolina University physical therapy anatomy course. The course instructor developed a Background Knowledge Probe to assess student preparedness. The probe, consisting of 62 questions, was administered to students the first week of classes and again at the end of the course. Those who did poorly on the first probe (pretest) also tended to do poorly on the second probe (posttest). Mean scores on the pretest positively correlated with the final course grade. These results suggest that administering a Background Knowledge Probe can alert the instructor to areas of weakness and aid in determining student’s success in a course.

** Kathy Starr presented a poster (#126) on this topic at the 29th Annual HAPS Conference in San Antonio, Texas in May 2015.

Introduction
Prior to entering the Doctor of Physical Therapy (DPT) program at Western Carolina University students are required to successfully complete six to eight semester-hours of human anatomy and physiology either as individual courses or as a combined anatomy and physiology course sequence. A Background Knowledge Probe (Angelo and Cross 1993) was administered to incoming students to assess whether they had the foundational knowledge necessary for successful completion of the physical therapy department human anatomy course, PT 821.

Methods
The instructor created the Background Knowledge Probe by first compiling a list of essential information based on a review of curricular materials for PT 821. The probe consisted of 62 questions (multiple-choice, fill-ins, true/false) with answers verified using current anatomy and physiology textbooks to insure accuracy and to be consistent with the way in which the information is presented in undergraduate anatomy and physiology courses. Students were also asked how they perceived their anatomy background before entering the DPT program. For three years, the probe was administered in the first week of classes (designated pretest, n=95) and again after the course was completed (designated posttest, n=94). Mean scores on the pretest positively correlated with the final course grade. These results suggest that administering a Background Knowledge Probe can alert the instructor to areas of weakness and aid in determining student’s success in a course.

Results
The mean score on the pretest (68%, SD = 8.73) was determined to be significantly lower than the posttest (76%, SD = 11.53) using a paired sample t-test (t94 = 7.692, p<.001). There was a positive correlation between how students perceived their background for anatomy and their performance on the pretest (r_s=.338, p=.001). A majority (64.2%) felt their background was adequate but with some areas of weakness. There was also a positive correlation between a student’s pretest performance and course average for PT 821 (r_s=.262, p=.010). Students most often felt that the nervous system and cell biology were areas of weakness in their anatomy and physiology background.

Review of application data revealed that there was no significant difference in performance on the Probe based on (1) undergraduate major, (2) grade point average in undergraduate anatomy/physiology courses (3) location where the last prerequisite A&P course was completed (college/university vs. community college), or (4) the amount of elapsed time since completing the last anatomy and physiology prerequisite course.

** Participant Profiles: Students enrolled in PT 821 were 63% females, 37% males ranging in age from 23 to 43. Most students (52%) had degrees in movement sciences/sports but majors in biology, psychology or health related fields were also common. According to application data 42% of students had competed their last anatomy, physiology or combined anatomy and physiology course in the year prior to entering the physical therapy program.

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Conclusions
The Background Knowledge Probe is not a standardized test. It was designed to assess foundation knowledge specific to PT 821. The instructor was able to show that those who did poorly on the first probe (pretest) were aware that their background knowledge was weak, and tended to have a lower course average in PT 821. The probe was also useful for identifying potential areas of weakness. The results of this study suggest that a Background Knowledge Probe may be helpful in identifying areas of weakness in students’ background and serve as a useful predictor for student performance in a course.

Reference cited:

About the Author
Kathy Starr attended Albany Medical College and earned a PhD in Anatomy in 1992. After teaching for three years as an anatomy and physiology instructor at a local community college she began teaching anatomy, pathophysiology, and neuroanatomy in the physical therapy program at Western Carolina University (WCU). She has been an Associate Professor at WCU for 19 years. In 1996 she became a member of HAPS and she has attended thirteen annual HAPS conferences. Kathy has served on the HAPS EDucator committee for several years and she has successfully completed two HAPS-Institute Courses.
Abstract

Graphics can be an invaluable learning tool for anatomy and physiology students. On the other hand, some images can be confusing or overwhelming. How much is too much? Too little? This NSF-funded project aims to explore graphic representation in instructional media, develop a methodology of optimizing abstraction in educational graphics, produce a set of learning materials for anatomy and physiology called Infograms, and test Infogram effectiveness in the classroom. Infograms, or graphic symbolic summaries, are unique learning materials developed at New York City College of Technology. They employ key terminology, abbreviations, pictograms, simple charts, diagrams and line drawings to encode and condense information. In this workshop, we discussed different types of graphic representation, from realistic to more abstract, trying to identify the optimal levels of abstraction for different media. We will also show how symbolic graphics can guide student learning in a more efficient way and provide examples of successful implementation of the approach.

** Vasiliy Kolchenko presented a workshop on this topic at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.

Introduction

Do you use images and graphics in your teaching – illustrations, pictures, sketches, graphs, tables, bulleted or numbered lists, keywords, short definitions, etc.? Of course you do. Actually, this may be all you use in your presentation slides. Visuals are essential, especially for a subject like anatomy and physiology.

From a pedagogical point of view, there are two questions here: what to use and how to use it? What are the best, most efficient graphics for student learning, and what are the best ways of using them? The answers are not simple. Often we do not understand enough how our students learn and what kinds of cognitive problems they have.

For two years in a row, the opening plenary seminars at the HAPS annual conferences were about educational visualization. In 2014, the seminar’s title was “Visualization potential meets cognitive load in anatomical education” (Wilson and Soon, 2014). The main thrust of the talk was about the cognitive overload that many beautiful but overly detailed and complex images impose on underprepared students. Instead of helping, these images may overwhelm and frustrate: “Many (students) are choosing the more difficult learning tool and they are being cognitively bombarded. The ability… to visually overload our learners is very real.”

In 2015, the seminar abstract stated that “Many college students do not adequately comprehend visualizations and fail to draw connections between what these visualizations depict and content conveyed through other means.” (Van Meter, 2015).

mean a lot to the instructors do not necessarily mean as much to the students, particularly if the students lack basic skills of reading and comprehending those graphics.

The usual advice is two-fold: avoid the cognitive overload in images and emphasize the importance of graphic literacy skills. Obviously these are good suggestions, but it is easier said than done. What are the practical steps and available tools that can help? How much detail is too much? Too little? What are the cognitive mechanisms that can make this kind of learning more efficient?

In this project, I explore graphic representation in instructional media, develop a methodology of optimizing abstraction in educational graphics, produce a set of learning materials for anatomy and physiology called Infograms, and test Infogram effectiveness in the classroom.

Materials and methods: What are Infograms? What are they for?

Symbolic graphics are used all the time. Road signs, computer icons and emoticons are pictograms. Words can also be symbols. When preparing to give an impromptu talk, you may jot a few notes on a napkin, but these words can guide your remarks and provide the required structure for a long speech. This is possible because each word has special meaning to the speaker.

Educational Infograms translate curricular material into a series of graphic symbols. Learning activities make these symbols meaningful for the students. Then the symbolic narrative becomes a powerful tool for creating your own version of the story.

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The concept of the Infogram was first described in 2012 in my NSF proposal Infograms for Undergraduate Biology (award #1245655). Infograms are graphics that optimize the material’s level of abstraction for better learning. They are:

- Graphic symbolic summaries
- Cleansed from confusing details as much as possible
- Cognitive devices – graphic scaffolding, supports, prompts
- Used for information encoding and decoding
- Helpful in multiple retrieval and fast review of material
- Utilized by exercising visualization skills – memory, imagination and creativity
- Designed for constructing rich meaning from increasingly abstract graphic symbols

For this project, I am developing Infogram-style materials in print, slideshow and video formats. In print, the materials for a topic cover one week of the curriculum, approximately one chapter in the textbook, and include:

- One-page Infogram with side notes that serve as a legend or key
- Infogram text description that helps students to decode the graphics in and outside the classroom
- Infogram term list used as a checklist for testing and self-testing
- Infogram homework assignment

The central component is the one-page Infogram (Fig.1). It consists of four to six units – short “stories” that reinforce each other and use key terminology, abbreviations, pictograms, simple charts, diagrams and line drawings to encode and condense information.

A set of Infogram materials for the first semester Anatomy and Physiology course, BIO2311, has been developed and used for a few semesters at New York City College of Technology, an urban federally designated Hispanic Serving Institution with an open access policy.

In class, one Infogram unit is presented and illustrated with a PowerPoint slideshow. After approximately 15 minutes, the instructor will ask students to work for five minutes in groups of two or three explaining the unit to each other and figuring out what was not clear during the presentation. The instructor can use this time to answer questions from within the groups, as students are usually more comfortable asking questions in this informal setting. This also provides important feedback for further improvement of the Infograms.

Next, I usually ask the class to review the unit term list for another couple of minutes. I call on individuals, so the students learn that they may be asked to explain any term on the list. This provides additional motivation for using the discussion time efficiently and for paying attention during the presentation of new material.

We also have multiple brief Infogram previews and reviews on the dates both before and after each topic is presented. This way, the material is discussed many times in different contexts. For example, during the lab students will be asked to explain the previous week’s Infogram to the class and to each other one more time. They are also required to recreate a handwritten copy of the entire Infogram from memory, which takes about 15 minutes. Meanwhile the instructor uses the time to talk individually with 7-8 students in order to ensure that they understand what they are writing.

This written assignment is graded, and the grading is done quickly, at a glance. Most students receive an A; if they need a makeup to improve their grade, it is not only allowed but encouraged—this is a valuable learning activity, as well as an assessment tool.

As a result of these multiple reviews, each student explains the material many times: first, to another student, then to the class, to the instructor, and, most importantly, to herself. All these activities become productive through the use of efficient graphic scaffolding that provides timely prompts for the narrative.

**Discussion: What is too much? What is too little?**

Types of educational visuals in various media include the following:

- print (text: detailed, summaries, charts, tables; images: photographs, illustrations, drawings, diagrams)
- presentation slideshows (structured summaries, images, charts, tables, integrated video and sound)
- instructional video (animations, lecture recordings, virtual sketch-board videos, documentaries, etc.)
A unifying theme, often underappreciated, is the level of detail and degree of abstraction. Even realistic images, which are particularly important in anatomy and physiology, can be more or less detailed and have to be labeled and understood. Otherwise, they are of limited use. There is always a question: how much information should be provided and how abstract to be in the presentation?

For example, in the midsagittal MRI of the brain (Fig. 2) we go from a labeled image to one with abbreviations and then to an unlabeled image with numbered structures—from less abstract to more abstract. In this case, the image with abbreviations is the Infogram. It provides useful and concise prompts for decoding.

Another example is the Infogram for the organs of the eleven organ systems. In the first unit of the course one of the HAPS learning outcomes is to “list the organ systems of the human body and their major components.” However, attempts to review dozens of organs in a few minutes during class may be frustrating both for students and for the instructor. Without structured information and easy visual reinforcement this topic is often assigned as homework: “It is in the book.” How can an Infogram cover this highly informative material?

By grouping the organs in a logical manner and using abbreviations, we can condense the names of every major organ to just three lines (Fig. 3). Here, the system names are underlined and the organ names are positioned in the proper sequence. As an instructor, you can probably solve this linguistic puzzle and imagine all the components quite easily. Students need to be primed with a clear, labeled diagram of each system, but they assimilate this information surprisingly quickly, if it is symbolic and structured.

In the top line, the first system is indicated by $\text{R: } \mathbb{F} \text{OFU}/M$ with an arrow underneath. Which system is this? It is the female reproductive tract (ovaries, Fallopian tubes, uterus and vagina) plus the mammary glands (M). The structure and function of all eleven systems can be similarly decoded, imagined and understood.

Once the students internalize all the images and the Infogram, review becomes fast and meaningful. Abstract and symbolic thinking are highly efficient because a little can represent a lot. This is a defining feature of human intelligence. When rich associations are created and reinforced, very little can say very much. When associations are weak or absent, learning materials become incomprehensible. Being educators, we help students build these meaningful associations and use existing ones, if available.

As our students develop abstract thinking skills and graphic literacy, they learn more than anatomy and physiology. They also learn how to learn better.

Results and Conclusion

To quantify the results, we conducted a comparative study using a pretest and posttest in the Infogram and control groups. The pretest scores were about the same (Infogram group, $n = 79$, mean = 33; control group, $n = 78$, mean = 29). The posttest results demonstrated a statistically significant difference in learning outcomes (Infogram group, mean = 74; control group, mean = 53). While the average scores improved in both groups by the end of the semester, the Infogram group showed an increase in scores that was 70% greater than in the control group.

Infograms appear to contribute substantially to the quality of learning, but they also help students learn more material in less time. The Infogram set follows HAPS learning outcomes. Only after developing the Infograms did I realize how much material hadn’t been covered previously. The reason was simple: it was unrealistic to expect our students to learn so much in so little time. However, we find time for much more material...
now, both for the expanded content and for the diverse learning activities. In fact, in Spring 2015 my class completed the curriculum one week before the final exam and used the week for review.

Students’ attitude changed as well. As they work harder and learn more, they complain less. Now, it is unusual to hear “Why do we have to know this?” or “This is too much!” When the Infogram learning system is used efficiently, the students remain constantly involved in a kaleidoscopic routine of familiar learning activities that bring almost immediate results. Because their work is meaningful and successful, students respect the subject more, and they are willing to invest more time and effort in learning.

For dissemination, I produce short educational videos which are published on YouTube (Kolchenko, 2012, 2015). Infogram videos for action potential generation and synaptic transmission (Fig.4) have attracted a growing audience. They have been viewed more than 68,000 times in 174 countries and have generated positive feedback.

In conclusion, let us return to our original question about graphic representation in anatomy and physiology. Can less be more? The answer is yes, but only if the graphics are highly symbolic and meaningful to the students. Infograms help us to make this transition.

About the Author

Vasiliy Kolchenko is an associate professor of biology at New York City College of Technology, The City University of New York. Vasiliy teaches Anatomy and Physiology and Bioinformatics. His research includes biosensor development and graphic representation in science education. He also writes and performs music. This is his Teaching Science song: https://www.youtube.com/watch?v=CpeI5wHvKE4

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View It, Then Capture It: A Histology Atlas for Better Understanding and Learning

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Abstract:
Student performance in histology can be significantly enhanced by the use of several laboratory pedagogical tools. In a recent workshop, we showed that projecting real-time slide images using a light microscope fortified with a built-in camera significantly improved student understanding and learning outcomes. In the conference workshop, we demonstrated how this microscopy tool was used to create and develop an in-house histology atlas. This atlas will serve as an important study resource elucidating several different slide views and optimal magnifications of tissue specimens. It will allow students to take home an exact copy of specimens seen in the laboratory for independent review and reinforcement of laboratory learning.

** Hisham S. Elbatarny presented a workshop on this topic at the 29th HAPS Annual Conference in San Antonio, Texas in May 2015.

Introduction and study overview
Histology is a challenging subject for students and mastering it requires practice at many educational levels (Johnson et al. 2014, Shoepe et al. 2014, Zanetti 2013). In a recent study, we showed that the use of different pedagogical tools in the laboratory could significantly modify student performance and enhance student-learning outcomes. We documented that projecting a real time image of a tissue slide, using a light microscope fortified with a built-in camera, significantly improved student understanding and performance compared to traditional methods. This microscope was connected to a computer and, using appropriate software, images of the tissue could be adjusted, labeled, and saved for future reference (Elbatarny 2014).

In the current study, we aimed to develop an in-house histology atlas using local histology slides and equipment. In preparation for the atlas, images of different views of significant body tissues were captured at the most optimal power of magnification. These images were edited and formatted using appropriate software. The images were then described, labeled and ultimately prepared as printable pictures within the atlas. The atlas will be available as a study resource for nursing students at St. Lawrence College in the Fall of 2015. It will be used to facilitate the study of the histology section of the laboratory component of the Human Anatomy and Physiology course (LUSL 2105).

Building the histology Atlas
Using a compound light microscope with a built-in camera in the molecular biology laboratory at St. Lawrence College, images of histology specimens were captured. These specimens were organized by organ systems. Specimens were captured at varying magnifications depending on tissue type and all four levels of magnification, 40X, 100X, 400X, and 1000X, were utilized. Specimens were labeled and saved according to tissue type and magnification (Figure I). A brief introductory description was created for each system. The atlas content was guided by the Human Anatomy and Physiology (LUSL 2105) laboratory syllabus and was referenced by published anatomy textbooks and laboratory manuals such as Marieb and Mitchell 2013 and Martini et al. 2014. Within systems, each tissue was described with a focus on histologically visible structures. All images were sent to the graphic designer for digital transcription, which included color conversion, editing, formatting and labeling using InDesignTM software. All labels and text were reviewed and approved before the final printing. Figure 2 shows a snapshot of the completed atlas.

Future work
While this atlas is expected to be a valuable resource to enhance the students’ learning, understanding, and performance, an objective evaluation of its impact is yet to be performed. In the upcoming year, a structured comparative study will be designed to investigate the role of this atlas in improving student performance in microscopic anatomy.

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Figure 1: Histology specimens are labelled and saved according to tissue type and optimal magnification.

Figure 2: A representative snapshot of one of the pages of the completed atlas illustrating the digital transcription: color conversion, editing, formatting and labelling using InDesign™ software.
References cited


About the Authors

Dr. Elbatarny is a consultant internist medical doctor who received his medical training in Egypt. His primary area of research interest is in cardiovascular biology. Dr. Elbatarny is currently a professor and tri-campus science lead at the School of Baccalaureate Nursing at St. Lawrence College in Kingston, Ontario, Canada where he teaches Human Anatomy & Physiology and Clinical Chemistry to BScN degree program students. He is also an adjunct assistant professor at Queen’s University in the same city where he has participated in the teaching of a number of Pharmacology courses and a course in Pathophysiology. He is the founder of the Anatomy Museum at St. Lawrence College. Dr. Elbatarny has over 20 years of experience in medical practice, research, and teaching in several countries including Egypt, Kuwait, the UK, and Canada.

Jennifer Hutchinson graduated with honors from Queen’s University in 2012 with a BS in Biology. She will receive her BScN degree from St. Laurence College/Laurentian University in the fall. Jennifer is the recipient of the St Laurence College Dean’s List award for top academic achievement by an individual in the BScN program. While studying at St. Lawrence/ Laurentian University, she has served as a peer tutor in human anatomy and physiology, microbiology, clinical chemistry and pathophysiology. Outside of her studies Jennifer is an accomplished soccer player having represented her home province of Newfoundland and Labrador on the national stage and earning CIS gold with Queen’s University in 2010, where she received first team all-Canadian honors.

Hilary Hough has always been interested in graphic design. Her specialties include type setting, illustration, and book design. In the future, she hopes to be able to open her own graphic design business. When she is not actively engaged in artistic ventures, Hilary enjoys outdoor activities such as hunting, boating, and just being outside when the weather is warm.
As instructors, we are very likely to use images in our courses to help explain or reinforce course information. In doing so, it is important to ask ourselves the following questions:

i) Are students actually meeting our learning expectations from the images that we use?

ii) Are students able to comprehend and benefit from the diagrams we choose?

Through a series of enlightening experiments, Dr. Peggy Van Meter’s research has suggested that students are not able to interpret diagrams nearly as well as their instructors think they do.

In the first study presented by Dr. Van Meter, 305 first-year students at Pennsylvania State University were given a quiz that consisted of 34 multiple choice questions. Each question contained a high-school-level diagram. Successful completion of this quiz required no prior discipline-specific knowledge. This study was designed to determine how well students could interpret visual representations and find answers to questions using images and accompanying text. In this study, students scored an average of 23 out of 34 correct answers or 70%, which was much lower than expected. It is important to note that not all of these questions were in the field of biology. Nine questions pertained to geoscience, which served as an inherent control in determining whether any prior discipline-specific knowledge may have been beneficial to the students. After analyzing each question’s responses, it was found that students did not find the geoscience questions easier or harder than the biology questions.

In the quiz, answers were embedded in figure headings or labels within the diagram. It became apparent from this study that students had difficulty interpreting conventional signs within images and making connections between caption text and the image itself. Dr. Van Meter noted that similar studies have found that animations and videos are also challenging for students who have difficulty interpreting visual representations. It is possible that pairing any type of auditory information with visual stimulation is inherently perplexing for some students.

Although, at first glance, this research may be disheartening and may make some instructors question the value in using illustrations at all, it is important to remember that many studies have shown that both comprehension and memory of material have been improved when illustrations convey the meaning of the text (Pressley 1997, Levin 1982, Levin 1983). In addition, images provide vital assistance in allowing students to make connections and inferences between related subject matter that might not necessarily otherwise occur from reading the text alone (Levin and Mayer 1993).

In the second study presented by Dr. Van Meter, twenty first-year science majors at Pennsylvania State University participated in an eye-tracking experiment. Their eye movements were recorded as they read three pages of text on the reproductive system that included both text and figures. During this analysis, eye movements and attention were logged. The number of transitions (eye movements) that were made between the text and figure sections were recorded. This number was called the transition variable and was thought to be a good means of measuring the amount of integration effort applied by the student. Students spent an average of seven minutes looking at text and only two minutes looking at diagrams. Following this activity, a post-test on the reproductive system was used to determine how much knowledge each student had gained during this exercise. Test scores were then compared to the eye-tracking data. It was found that eight of the twenty students earned high scores on the post-test. Of those eight, six students had also scored highly on the integration effort (transition variable) component. Only two students scored highly on the post-test despite having minimal visual interactions with the images during their reading of the material. It is possible that these two students were more adept at understanding the text alone, or perhaps they were able to provide their own mental imagery as they read the text.

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The second study suggests that for most students, text and visual images are both helpful. So what can we do to increase our students’ abilities at interpreting diagrams?

The immediate answer might be: let’s improve our students’ metacognition by offering tips or providing better instructions. The third study will explain how this might be accomplished.

In the third study presented by Dr. Van Meter, 224 first-year science majors at Pennsylvania State University were asked to read twenty-three pages of electronic homework. The assigned pages consisted of text accompanied by twenty-five diagrams. The students were divided into 4 groups, each of which received a different set of instructions. The impact of each type of task instruction was then monitored. The task instructions were specifically designed to engage various levels of student metacognition and study strategy performance. The four different forms of task instruction were as follows:

i) **Instructor Video Clip**: A video clip of the instructor telling the students to pay particular attention to the diagrams in the homework assignment was played when the assignment was given.

ii) **Self-Explanation (SE)**: Students were told to use self-explanation to pay attention to specific concepts in the homework. In this study, SE was promoted by asking learners to identify the key concepts and explain how the key concepts work.

iii) **Note-Taking**: Students were told to take notes on the material.

iv) **Direct Response (DR)**: Students were given instructor-written, content-specific questions on each page in addition to the regular homework.

After completion of the homework, student comprehension of the material was tested with an assortment of text questions, diagram questions, and questions containing verbal descriptions of the diagrams. It was found that for the diagram questions, students that had been given the Instructor Video Clip instructions performed the best. Students that had either SE or DR tasks with their homework scored average marks on the same diagram questions, and students that had taken notes scored below average on the diagram questions. On the text questions, it was found that all the students had average scores, except those students from the note-taking group, who scored below average.

Interestingly, these studies differ from a previous text-only (diagram-free) investigation by Firetto and Van Meter (2012) in which they found that task instruction did not greatly affect students’ reading and studying of two different assigned texts, as assessed by comprehension quizzes. In the previous study the task instructions were much different and dealt with integration of two different texts.

In sum, this study suggests that, when content contains diagrams, having the instructor actively tell students to pay attention to the diagrams is the most helpful study strategy. Self Explanation and Direct Response instructions are somewhat helpful and note-taking, on its own, is not a very effective study strategy. This data suggests that a student’s level of diagram comprehension may be very influential on their overall ability to understand, remember, and fully master course content.

The fourth study presented by Dr. Van Meter involved studying students’ cognitive operations with respect to diagrams. In this study, a test was created to measure students’ internal mental operations, specifically in relation to how well diagrams were interpreted. It measured students’ ability to elucidate answers from figures and accompanying figure captions. After collecting the cognitive operation scores and categorizing them as high, medium, and low, the medium scores were thrown out and correlation analysis was performed with the high and low scores. The results of this study suggest that students answer text questions, diagram questions, and text-and-diagram questions more accurately if their diagram comprehension skills are high.

In conclusion, Dr. Van Meter’s thought-provoking presentation left conference attendees with many things to think about in terms of course design and presentation. In addition to the things discussed by Dr. Van Meter, other factors that may contribute to success with visual representations might include a student’s ability to follow instructions; the amount of time and motivation that the student may have for the task; the quality of the image and the readability of the text; a student’s prior knowledge; the amount of anxiety a student may feel; the time of day; and perhaps a host of personal factors that affect a student’s individual abilities. In addition, the storage capacity of a student’s working memory may come in to play, especially during a fast-paced or lengthy lecture. How much new material can a student store at once and for how long? With very complex pictures, should we be worrying about cognitive overload for the student? When designing assignments that include SE or DR, is it important that we address things like: placement of these questions in relation to relevant content; providing ample room for writing in answers; replying with quick and relevant feedback to SE or DR questions; and incorporating appropriate incentives for successful completion of the task?

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Thankfully, Dr. Van Meter provided several take-home messages to assist the decisions that need to be made. These include:

i) Know your students’ limitations and abilities in interpreting and understanding text and diagrams.

ii) Reform your courses to improve the instruction of visual representations.

iii) Create visual worksheets.

iv) Add diagram questions to exams to signify their importance.

v) Draw with students in class. (For a comprehensive review of using drawing as a learning strategy, see Van Meter and Garner, 2005, and for research on the relative successes of using drawings and illustrations in Grades 5 and 6, see Van Meter 2001).

As a final note, it is apparent that the learning and creating of art in K-12 nurtures visual literacy skills which are beneficial to disciplines outside of Fine Arts.

"After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are always artists as well."
—Albert Einstein

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About the Author

Zoe Soon has been an Instructor in the School of Health and Exercise Sciences, Faculty of Health and Social Development, University of British Columbia, Okanagan, Canada since July of 2011. She holds patents in elemental analysis of tagged biologically active materials and high-throughput screening of metabolic disorders using a laser desorption ion source coupled to a mass analyzer. Her areas of expertise include skeletal and cardiac muscle cell biology and pathophysiology.
The second update speaker at this year’s HAPS annual conference was Dr. Peter Ward, an Associate Professor at the West Virginia School of Osteopathic Medicine. Dr. Ward has a background in Anatomy Education, including educational theory and educational research methods. He enjoys exploring new teaching methods, and researches how these teaching methods impact learning of anatomy by medical students.

In his seminar, Dr. Ward discussed the importance of educational research for assessing new teaching techniques and strategies, and the effectiveness of those techniques. Educational research involves the study of both the educators who teach, and the students who learn. Educational research may be conducted to provide data for an individual educator about their own class, or to advance our knowledge of education and improve educational practices. For example, educators can benefit from conducting educational research to explore the effectiveness of different interventions in their own classroom, and to improve student attitudes and outcomes in those courses. Additionally, educational research can generate generalizable data that can help to inform and advance our understanding of teaching and learning in our discipline.

Dr. Ward spoke about the basic categories of educational research methods, quantitative and qualitative, and how one’s approach depends upon the goal and circumstances. Quantitative research relies primarily on collecting quantitative, or numerical, data while qualitative research relies on collecting qualitative data. There is overlap between these two categories, and they can go hand-in-hand. Educators often use quantitative and qualitative research methods to answer questions in educational research, a process known as a mixed methods model. For example, a researcher might be investigating a drug’s effects on lowering cholesterol, but have outliers. A qualitative follow-up with the outliers might seek to discover any factors that could explain why they showed variance from the typical response.

Although as science faculty, we may be more familiar with quantitative research, it is not always ideal or even possible in educational research because of the nature and limitations of the classroom environment. It may be difficult or impossible to control variables (e.g., gender or ethnic distributions), or to randomly recruit subjects. The educational researcher needs to utilize the learners at hand, who may or may not be representative of the general population of learners. Furthermore, an educator may wish to study “outliers”, who are not representative of the population as a whole. Thus, a qualitative approach, or a combination of quantitative and qualitative methods, may be useful.

Dr. Ward focused on discussing qualitative methods in educational research, which is perhaps less well known amongst educators. He emphasized that qualitative methods do not necessarily test hypotheses. In fact, in many qualitative studies, the classroom setting precludes control over the many variables involved. Instead, qualitative research can help you get a handle on what is going on; it describes and analyzes a pattern of relationships. However, qualitative research is not simply descriptive. Qualitative research is a way to apply inductive reasoning to a variable and attempt to draw inductive conclusions. Thus, qualitative research generally involves coding of data in some way to extract themes. (Coding refers to determining and assigning themes to data, such as interview responses, to characterize the themes in the responses that are collected.)

Thus, even though one utilizes a qualitative approach, it is important to carefully consider how to design the study, the question one wishes to answer, who to sample, and how to collect and analyze the data. For example, in trying to determine whether a new teaching approach was effective, you would not simply want to say we did something in the classroom, and the students seemed to like it. Rather, you would want to engage in purposeful sampling and data collection, and utilize data and investigator triangulation.
Purposeful sampling means that you want to select a specific group that will provide rich data for analysis. Purposeful sampling does not create generalizable findings, but rather leads to applicable results that can inform and guide people in similar situations. Dr. Ward discussed a variety of sampling options depending on the research question: looking at deviant cases and sampling extreme cases; finding common patterns within a wide array; choosing subjects who represent a variety of levels within a certain spectrum, for example, focusing on the high and low ends and throwing out the middle group; selecting certain ‘important’ subjects, for example those with a learning disability; sampling only students who meet some pre-defined criteria, for example pre-med students; or choosing a random, representative sample of a given population.

In gathering data in a qualitative study, one can also utilize different data collection strategies. One strategy is to conduct interviews. Interview questions need to be carefully designed, so the subject can tell you what’s important and not be constrained by the format of the question. Subject answers then need to be recorded, transcribed, and coded. Other techniques for gathering data include documents or other artifacts (e.g., exam essay), and direct observations (e.g., classroom observations of student behaviors, such as engagement using a given technique). Another factor to consider is that qualitative research is subjective. Thus, it is important to utilize data and investigator triangulation, the process of gathering multiple sources of data to answer a given research question and having multiple researchers code the data, as a way to address and control for this shortcoming. In using triangulation, you are therefore attempting to research a phenomenon from different perspectives to elucidate what is valid, and what is an artifact.

Dr. Ward concluded by providing several examples of his own research utilizing a mixed methods approach to examine how the study approaches of veterinary and medical students impacted their performance on exams. One outcome was the ability to identify students at risk for not performing well on board exams a year before the exams, and to intervene with counseling to help students be more successful.

Thus, educational research can take many forms, depending on the situation and research question being addressed. A key consideration is that educational research needs to be carefully and purposefully designed in order to gain real, meaningful data that can provide valuable information and insights about teaching and learning practices for an individual educator, or for a broader educational audience.

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**About the Author**

Janet Casagrand is a senior instructor in the Department of Integrative Physiology at the University of Colorado at Boulder where she teaches a variety of courses including Human Physiology, and Neurophysiology. She is passionate about undergraduate education, and continually strives to improve her students’ learning experience. She has incorporated evidence-based learning techniques in her classroom, and is involved in science education research to explore how students learn best.
Research in educational settings can be a convoluted and lengthy process. Although educational, biological, and field research share goals of elucidating findings from experimental data, there are drastic differences to keep in mind when conducting research in the classroom. Luckily, Dr. Dee Silverthorn eloquently lit the path from initial planning to publication during her seminar at the conference. During her presentation she offered advice rooted in experience and gave suggestions for conducting your own educational project. Trained as a bench scientist, Dr. Silverthorn shared that her journey into formal educational research began incidentally while teaching at the University of Texas at Austin. She spoke from experience as a teacher who was the principal investigator for a teaching grant, as a chair of a national grant review committee for the NSF, and as an editor for a peer-reviewed journal in which she is responsible for making publication decisions based on how well research projects are constructed and described.

Dr. Silverthorn began by emphasizing realistic expectations when conducting educational research, noting her humbling experiences of projects that did not run smoothly from the beginning to the end. For example, she described an NSF funded project where active learning modules were developed based on physiology themes. HAPS members across institutions were recruited as beta-testers to assess the modules. However, the following year her team realized that the project was far from completion as the beta-testers began to drop out for various reasons and not a single module had been tested. After investigating why the modules were not implemented, Drs. Silverthorn, Thorn, and Svenicky published a paper with their findings (Silverthorn 2006).

From these experiences Dr. Silverthorn shifted the talk, systematically breaking down the process of educational research by describing “The Three P’s”:

1) Planning  
2) Permission  
3) Publishing

Planning
Can you articulate the question you intend to research? What do you want to know? Having clear goals will help remind you where you are ultimately going with your project. Apply backward course design to your research, starting from a broad or general construct and working toward the more specific objectives. Also, consider competency-based research (such as skills and behaviors) as well as the content.

As an editor for a peer-reviewed journal, Dr. Silverthorn has noted that many who submit documents to a journal have not done an extensive review of the literature. Conducting a thorough background search is a vital step in understanding how your contribution will fit into the existing pool of knowledge. Sources for investigation include: Medline, ERIC (Education Resources Information Center), and Web of Science. However, Dr. Silverthorn advised not to feel restricted to biomedical and life sciences research; instead, start collaborating, attend meetings, and investigate alternative resources.

Next, understand what type of data you will be collecting and how it will be obtained. Your initial literature search can help guide you during this process. Classic methods of data collection include a repeated measures design, such as pre- and post-tests, and content inventory assessments. Although perception surveys are valuable by providing rich insight into the thoughts of your students, they do not elaborate results of formal qualitative research methods. Since student perception and reality are not exactly aligned, a student simply “liking” something is not necessarily an indicator of effectiveness.

When considering your study’s design, how are you going to set-up the experiment? This may be a challenging question to answer since controlling variables is difficult when you are restricted to a pre-selected class of learners and you may not be able to recruit subjects randomly in order to generalize. A classic approach is to experiment one semester with an intervention that is different from previous semesters, then assess similarities between the two classes. Alternatively, the concurrent group model can be employed, where control and experimental classes occur simultaneously. However, Dr. Silverthorn imparted
a word of caution when utilizing the concurrent group model: students in the experimental class can study with students in the control class and closed Facebook groups allow students to collaborate with each other, thus invalidating the results of the experiment. Dr. Silverthorn's final words of wisdom when considering the planning stage of educational research were to follow grant instructions and IRB protocol meticulously and find a statistician before you get started. Obtaining institutional approval is necessary to conduct human subjects research in established educational settings, such as classrooms. Meeting with a statistician will ensure that appropriate data is collected from your experiment to perform the desired statistical analyses.

After explaining the planning portion of her Three P’s, Dr. Silverthorn walked through an example of applying these steps using the flipped classroom model (Jensen 2015). Using a concurrent group model, Jensen and colleagues found no significant difference in learning outcomes between the flipped classroom group and the non-flipped group. To explain this phenomenon, they went back through previous semesters discovering past students had one-third the amount of homework assignments as the experimental semester. After ensuring the student populations were similar, the researchers concluded that the flipped and non-flipped groups during the experimental semester were doing three-times as much work than the control semesters. Therefore, the “flip” of the flipped classroom model is not necessarily the cause of better learning outcomes.

Permission

Although students can be considered our “guinea pigs” in the classroom, they are still considered human subjects and the following ethical principals must be maintained.

1) Do no harm – this could become a tricky situation when setting up experimental and control variables in human subjects research. Since it is now largely recognized that active learning benefits students, excluding some of your students as the control group from an active learning environment may do them harm since you are not teaching them in the most efficient manner.

2) Student autonomy – you must give students the opportunity to opt out of your educational experiment.

3) Privacy – maintaining student privacy is essential for ethical research. It is very important that your research findings cannot be associated with a particular student.

Publishing

Consider your most interested audience and then look for sources. If your particular institution values publications with an impact factor, then there are two choices for anatomy and physiology: *Anatomical Sciences Education* and *Advances in Physiology Education*. If your research is more biology-based, then *CBE Life Sciences Education* also has an impact factor. Dr. Silverthorn advised to be prepared to defend your qualitative research when submitting to discipline-based journals as many scientists think that data equals numbers, not quotes.

At the conclusion of her presentation, Dr. Silverthorn explained what editors reviewing your manuscript will look for:

- The significance of your paper
- A compelling research question that is clearly stated
- A strong understanding of the background literature
- The design and quality of the presentation, with everything controlled that possibly can be
- The novelty of the paper (knowing the state of your field will allow you to continue adding to existing publications and avoid simply replicating previous work)
- IRB approval and appropriate permissions
- The study design, such as controls and variables, data analysis, and accurate statistical methods
- Does the author understand how the results fit into what is previously known?

By following the Three P’s, educational scholars can successfully navigate the road to publication. After thoroughly planning your research project and obtaining proper permissions, publishing will be the easiest part.

About the Author

Originally from Southern California, Barbie Klein received a BS from UC Santa Barbara in Cell and Developmental Biology. She left the sunny California weather to study at Northern Illinois University where she earned an MS in Human Anatomy. She is currently at Indiana University working on a doctoral degree in Human Anatomy Education. Barbie enjoys traveling with her husband David and her puppy Kaya.

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How About Them APPLES? Anatomists & Physiologists Learning Educational Scholarship

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Abstract and biography courtesy of the 29th HAPS Annual Conference Program.

Abstract: Why should we conduct education research? As HAPsters, we share a genuine interest in maximizing student learning in A&P and some faculty may have to partially satisfy some research-based P&T requirements. However, I argue that the long-range rationale for educational research in A&P is to improve patient care because A&P faculty share the common goal of teaching the foundational science that interprofessionally underpins all the health professions. This interactive seminar will discuss the who, what, why, and how educational research in A&P, with a specific emphasis on strategies for success in developing, implementing, and assessing educational research. Strategies for publishing your educational scholarship and for documenting your educational activity for faculty annual performance reviews will culminate the seminar.

Biography: Mark A. Terrell, Ed.D. is the Assistant Dean of Medical Education at the Lake Erie College of Osteopathic Medicine. In this role, Dr. Terrell serves as the Institutional Director for Faculty Development and for Inter-professional Education, serves as the Program Director for LECOM’s Master of Science in Medical Education Program, oversees Faculty performance evaluation, and participates in medical school curriculum reform. He has given over 50 faculty development training workshops in clinical practice settings and has organized and facilitated many faculty learning communities and other programs for improving basic science instruction in the medical school. Dr. Terrell has given many international workshops, has over a dozen publications, and multiple grants with funding exceeding $85,000, all centered on scholarships in medical education.

Dr. Terrell has taught over 10,000 students across a wide-range of higher education settings including medical school, large urban research-1 institutions, moderate-sized state colleges, and community colleges. As a graduate teaching assistant at Ball State, Dr. Terrell taught introductory biology and geology labs, and courses in medical microbiology and anatomy. In 2000, Dr. Terrell joined the faculty at the University of Southern Indiana in Evansville, IN to teach courses in anatomy, physiology, general biology, and statistics. In 2001, Dr. Terrell joined the faculty at Indiana University – Purdue University at Indianapolis to direct and teach the department’s largest course – undergraduate human anatomy, which enrolled over 1,000 students annually. Due to the educational scholarship surrounding the design, implementation, and analysis of various pedagogical innovations for the betterment of student learning in this course, Dr. Terrell received the Indiana University Board of Trustees’ Teaching Award in 2005 – Indiana University’s highest accolade for excellence in teaching. Later in 2005, Dr. Terrell was recruited by the College of Medicine at The Ohio State University to direct and teach their large-enrolling undergraduate anatomy courses. In 2008, Dr. Terrell was recruited by LECOM and currently serves in an interdisciplinary faculty position. Dr. Terrell’s current teaching assignments include teaching in the Master’s in Medical Education program, Medical Gross Anatomy, and Biostatistics.
Why does chronic alcohol abuse cause the effects of HIV to be worse? Professor Molina discussed the specific negative physiological effects of alcohol in those with HIV disease. There is a clear local impetus for this research as New Orleans is estimated to rank 3rd-4th in active HIV cases.

Professor Molina began by explaining that the effects of immunodeficiency virus infection plus excessive alcohol intake could be divided into two main groups of events: alteration of the immune system and metabolic regulation. The research group used a primate model infected with simian immunodeficiency virus (SIV). In addition, the animals in the research group were provided with ethanol at levels that would mimic those seen in a human binge drinker. For comparison, another SIV-infected group was provided with a sucrose solution.

The changes in the immune system include: increased lymphocyte turnover, tissue SIV replication, plasma virus counts, GI and vaginal CD-4 cells, senescence of CD-8 cells, and higher rates of SIV replication during pneumococcal pneumonia infections. Conversely, CD-83 myeloid dendritic cell populations declined.

The metabolic impacts (i.e. dysregulation) are through wasting; lower weight gain, declining body mass index, and declining skeletal muscle mass (SKM). Falling SKM is due to an ensemble of underlying issues including an increase in proteasome activity and inflammation. The proteasome activity results in the catabolism of muscle proteins whereas inflammation can be quite destructive. Conversely, researchers witnessed decreased anti-oxidant abilities, regeneration, and myoblast differentiation. In summary, there is more breakdown and less building in the skeletal muscle mass.

Professor Molina spent most of the rest of the seminar exploring the findings related to metabolic dysregulation. She presented charts documenting clear increases in mediators of skeletal muscle mass atrophy and negative regulators of muscle growth. The proteasome activity in the SIV and ethanol group was significantly higher than in either of the control animals that were provided with a sucrose solution. Collagen formation in the former promoted fibrosis in areas of muscle as well. Repair was also impacted as insulin anabolic signaling was also obviously disrupted. These and other points were underlined by micrographs comparing sucrose-supplied versus ethanol-supplied primates.

In a slightly parallel set of investigations, scientists working at the UCLA AIDS Institute and Center for Research found humanized mice were more easily infested with HIV when exposed to cocaine, another addictive substance (Sohn et al. 2015). This effect seems to be due to CD-8 (cytotoxic cells) being inactivated. However, these researchers were looking at the transmission of the HIV virus rather than the metabolic effects of an immunodeficiency virus, such as Professor Molina’s group were studying.

About the Author

David Evans is a Professor of Biology at Penn College, an affiliate of the Pennsylvania State University. He was the winner of the 2014 HAPS President’s medal and he has published numerous refereed books, websites, and articles. He is married to Henriette and they have two wonderful children.

Reference cited:

Appendix I: It is possible to ameliorate HIV and SIV with antiretroviral therapy (ART). A feature of ART in both HIV and in SIV cases is lipodystrophy. With antiretroviral addressing SIV, greater abdominal fatty tissue and lower levels of circulating adiponectin are found.

Reference cited for Appendix I:
Dr. Jose Bowen, musician, academic, and president of Goucher College, provocatively titles his book and seminars “Teaching Naked”. While I was quite certain that Dr. Bowen was not advocating a nudist lifestyle, I suspected he might spend the seminar discussing the evils of technology. In fact, he spent the majority of the session discussing how to use technology effectively – OUTSIDE the classroom.

Use Technology to Communicate

Instead of in-person meetings, young adults initiate relationships and establish the trustworthiness of a future partner using social media crowd-sourcing apps such as Yikyak. Online office hours, using a learning management system or closed Facebook group, can thus be more effective for students who would feel intimidated coming to a professor’s office. Social media can also be used for specific aspects of the “Teaching Naked” cycle, discussed further below. Communication methods should be established and tested early, perhaps by using e-communication to provide the syllabus (and including a link to a syllabus quiz).

Establishing e-communication guidelines can alleviate common concerns regarding the use of social media in a professional setting, such as the invasion of personal privacy and the 24-hour-a-day nature of connectivity. For instance:

- List acceptable methods for student queries (e.g. LMS, email, Facebook, Twitter, text message, LinkedIn)
- Establish time limits and a schedule for replies (e.g. I will reply within four hours of your message, except for evenings after 5 PM and Sundays)
- Specify your policy regarding social media friend requests.
- Be clear and consistent about the appropriate communication method for different types of information.

Use Technology to Provide Content

Teaching Naked is, in part, about giving up control of both the content and the learning environment. Faced with a difficult concept, many students will turn to Wikipedia, Youtube, or an online course rather than consult the textbook and other materials we have thoughtfully provided. So, in accordance with the adage “Know thine enemy”, instructors should familiarize themselves with the Wikipedia and Youtube content for particularly important and/or misunderstood concepts. Repositories such as MERLOT (see link below) and, for our purposes, the Life Sciences Teaching Resource Community (LifeSciTRC), can also provide appropriate, and in some cases peer-reviewed, content. The instructor should, however, model how to use and critically evaluate these free resources.

Instructors can take this idea farther by creating their own online instructional materials. Podcasts, for example, can be used to “teach to the many, not to the middle”. Instructors can create multiple podcasts, using different explanations and analogies, for the same concept. Or, students can create 2-minute podcasts or videos explaining a particular topic, and the best can be used in future years.

Gaming can also be very effective in providing and reinforcing content. Games meet many requirements for good learning tools: they are interactive, pleasantly frustrating, and adaptive. They also allow students to fail with no (or few) consequences. Instructors can use apps such as Smashfact (see link below) to prepare their own gaming experiences; anatomy and physiology gaming sites preloaded with content are also available (Anatomy Arcade; Philips Medical Games).

The Teaching Naked Cycle

Dr. Bowen brings together these teaching and learning practices into the “Teaching Naked” cycle.

1. E-mail (or E-communication) to prepare. For instance, send students a Twitter message introducing the reading and why it matters. Optimal learning happens when the knowledge is both concrete and personal (Brown et al. 2014).

2. Online content for first exposure. In other words, do not use lecture time to provide content, because existing resources can deliver content more clearly and with higher production values. Moreover, learners can find the mode and timing that is most effective for them, be it reading the textbook or viewing seventeen podcasts.

3. Exam to evaluate. Use a learning management system or other method to provide a low-stakes reading quiz prior to each lecture. This step improves the chances that students will prepare for class, and also provides guidance as to topics that should be addressed in class.

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4. Writing opportunities to reflect. Knowledge is necessary, but not sufficient. Thus, students need opportunities to elaborate and contextualize newly acquired content. Writing assignments can be very short, such as writing a favorite quote on an index card or tweeting about the connection between the readings and real life, or more elaborate, such as a position paper or full-length essay. Optimal use of writing prompts (e.g. “What is the main bias of the author?”) and peer review can maximize the effectiveness of this step. Problem sets and case studies also fall under this category. The instructor can facilitate this step by sending caring e-communications, such as “Question 6 is really hard; keep it up!”

5. Class to challenge. Since the content has already been acquired, tested, and elaborated, precious face-to-face time can be used to challenge and motivate students. Ideally, group activities should incorporate both failure and complications. Class discussions should have clear learning outcomes and be linked to preparatory readings or other content. Importantly, instructors need to explicitly teach and model appropriate behaviors, questions, and comments. See Brookfield (2012) for additional tips for better discussions.

6. Cognitive wrappers to reflect. These brief questionnaires are administered after an exam or other assignment, and ask students to self-regulate their learning processes. First, students reflect on their preparation. For exams, cognitive wrappers ask students how much time they spent preparing, and what percentage of this time was spent in low-efficiency tasks (rereading, copying, repeating) vs. high-efficiency tasks (elaborating, integrating, teaching others). For essays, students report how much time they spent on the different steps (thinking, reading, researching, drafting, editing). Next, students analyze their performance, by providing reasons why they lost points (e.g. unclear question, anxiety, forgetfulness, lack of understanding, lack of time). Finally, they list potential changes that could improve their performance next time.

Teaching Naked and Flexible Thinking

Ideally, education should promote flexible thinking – the ability to alter an opinion in light of new evidence or perspectives. Instructors can promote this mindset throughout the learning cycle by “teaching with uncertainty.” For instance, Dr. Bowen advocates the use conditional instructions and feedback, such as “This could be the best solution”, instead of absolutes. Instructors can leave room for doubt and innovation by referring to “the current theory” instead of “the right theory”. Importantly, instructors should model intellectual flexibility by thoughtfully considering the impact of student input and new findings aloud in class.

Thus, Teaching Naked involves stripping technology from the classroom in order to facilitate face-to-face interactions. Moreover, it also describes the vulnerability of removing the safety net of a canned lecture. Dr. Bowen’s update seminar was rich in both conceptual ideas and practical tips, and cannot be adequately summarized in this brief article. In keeping with Dr. Bowen’s theories of content delivery, I refer readers to an academic article (Bowen 2006), a Youtube video (Bowen 2013), and a website (Bowen 2015) for more information.

About the Author

Kerry Hull teaches Physiology, Exercise Physiology, and Anatomy at Bishop’s University, a small liberal arts institution in Southern Quebec. A molecular endocrinologist by training, she has recently transitioned to what she terms the “much more satisfying enterprise” of pedagogical research. She has been attending HAPS conferences since 2008, serving on the HAPS Foundation and Scholarships committee.

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Smashfact. Available at: https://www.smashfact.com
A Book review
The Anatomy Lesson

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Publish a book called The Anatomy Lesson, and you should at least have the niche audience of morphological specialists in the academy as a target audience. The memberships of HAPS, AACA, and AAA will be overloading the servers at Amazon and other booksellers trying to get a copy, you’d think. And yet, as you’ll read, the numerous books titled The Anatomy Lesson all attempt to capitalize on the fame and familiarity of the Rembrandt painting by the same name. They typically fail, at least with the “easy pickings” audience of anatomists, anyway. So when Nina Siegal, an international correspondent for the New York Times, published her work of that name last year, it promised to crack open the tombs and dig up the old tropes of death, dying, and leaving a lesson for succeeding generations that our educational minds could easily wrap themselves around. And like many of the other books with the same name, it was directly connected to the iconic Rembrandt painting. In fact, the novel is a fictionalized account of how the famous painting came to be, set in a proper historical setting.

HAPSters and other anatomy-savvy readers will have some familiarity with the story of Rembrandt’s The Anatomy Lesson of Dr. Tulp and Aris Kindt thanks to the History of Dissection seminars of president-emeritus Bill Perrotti has presented at recent annual conferences. Others who have been interested in the Kindt/Tulp story may have even explored William Seabald’s Rings of Saturn or Laird Hunt’s The Exquisite, two books where tulips, Aris Kindt, and Nicolaes Tulp show up repeatedly in various guises to challenge our perceptions of guilt and punishment and provocatively explore our relationship with death and the body.

Because of such a wealth of factual information is available to readers, Ms. Siegal started out from a seemingly disadvantageous position, the facts she needs to invent have to be at least as interesting as those we can discuss over beers with Funny Uncle Bill. And here her imagination comes up a bit short. At least short of what my colleague Bill can offer me as historical fact.

After six years in the making, this book certainly highlights how sentences can become tight when they’re worked over and over again, and the rough corners of plot get smoothed and seamed well. Ms. Siegal certainly knows how to use language to evoke emotive responses from readers, but as a reader, you can’t help wondering if the author might not really be writing for someone else as you work through this book. Firstly, there are the rather simplistic headings that announce and identify the voice in the books narrative sections — headings that (by design or not) influence how we approach and orient our feelings towards the particular narrator. The writing should do a better job on its own of making those influences and illuminations happen for us. Sadly and secondly, there just isn’t enough “meat” on the bones of the story line to engage us much more deeply than the author’s thin prefab titular orientation to her characters and their stories.

One such logical gap was the notion that Rembrandt painted the large canvas of the darkly-toned Anatomy in the middle of the evening, by candlelight. In another, the story line followed the idea that Rembrandt might have
actually worked with the cadaver he dissected in order to get the anatomy of the left hand correct. Close examination by anatomically-trained eyes will lead to concerns as to whether or not Rembrandt did represent the anatomy correctly, but worse, the story line reinterpreted the real scientific study to come to a conclusion that was the exact opposite of what was reported in the literature. Not a shining moment, even for historical fiction. But it’s not as if any of the other books stand out as reasons why my bookshelf will appreciate in value — most of these titles under-perform, but share in common a desire to better understand humanity through an exploration of the “other” lying there cold on the table. An enterprising author of a future The Anatomy Lesson might well try and answer the philosophical question of what “restitution” the dissection of a criminal’s body might have paid to society as it is dissected, and if that restitution is sufficient — the digital human (convicted murderer) comes to mind. Siegal starts to wade into this set of ideas through the inner narrative of the anatomy assistant, Jan Fetchit, but like with many other aspects of her book, she ultimately doesn’t hit the target.

In summary, it was good to have read Nina Siegal’s The Anatomy Lesson, simply because it forced the reacquaintance with the other Anatomy Lesson titles on the bookshelves (and in the case of the photo book, seek it out). But HAPSters will be more likely to appreciate a non-fictional book about real anatomists and the stories of their cadavers. For me The Anatomy Lesson was like reading a Jodi Picoult novel — I feel hungry and unfulfilled at the end, knowing that the truth is much more complicated and messy than its portrayal in the hands of even a technically-gifted writer. All in all, the lesson of The Anatomy Lesson is that it can be risky asking fiction to explore an intense and complex subject and confront its big ideas meaningfully while trying to pose as a love story.

Below you can look at an annotated bibliography of the other available Anatomy Lesson titles.

**Annotated bibliography:**


A first-year medical student fresh from the Korean war as an infantry medic discovers evidence of foul play in the cadaver he and his lab partners are assigned to dissect. Written by a physician anatomist, the “where did this cadaver come from?” storyline rings true, and the descriptions of the days spent by students in the gross anatomy lab before the Anatomical Gift Act of the 1980s gives us a look into a time not far removed from our own, but light years away in terms of the procurement and use of cadavers.


A dark, creepy jaunt through post-9/11 Manhattan with an eccentric Mr. Kindt, Dr. Tulp, a beautiful exotic named Tulip, and others.


A picture book from the anatomy lab featuring staged photos of different settings in and around the dissection suite. The book features a set of re-imaginings of Rembrandt’s *Anatomy Lesson*, with titles such as *The Anatomy Lesson of Doctor Howard Riley*, or *The Anatomy Lesson of Professor Bernard Moxham*. A thin volume, made powerful by the textual insights that accompany the various photos.


A young man living in Amsterdam comes of age as his older brother dies. To receive his inheritance, he must witness his brother’s autopsy. The autopsy reveals a dark side to his brother’s life and that of his family. This is a book that Bret Easton Ellis (*Less Than Zero*) or Jay McInerney (*Bright Lights, Big City*) might have written in the 80s or 90s if either one had had a background in biology rather than social science.

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Another story where donor bodies (or donor body portions) show up in the cadaver-storage facility of the local teaching hospital. Part of the Inspector Harry Hole series of murder mysteries, this tantalizing story is more about everything *else* other than the fact that the Snowman is able to hide bodies in the fixative tank.


A psychological mystery involving a serial killer who stitches together various body parts from different victims and poses them in a challenge to the authorities. All in all, the plot is as stupid as it is gruesome, and represents the kind of pulp slasher/mystery book that gets turned into a direct-to-DVD horror movie. So of course, your 17-year old nephew might like it — that is, if he still reads books.


Finale of the *Zuckerman Bound* trilogy. Nathan Zuckerman, in yet another existential crisis, is also in a great deal of physical pain. His solution: go return to Chicago and go to medical school. Right. More pain awaits him, he finds out… This book was the least successful of the trilogy, and its obsessive navel-gazing and descriptions of ennui are painful to try and reread 30 years later.


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**About the Author**

*Jon Jackson* has taught anatomy and physiology and the history of science for the past twenty years. He is the Western Regional Director of HAPS and a Fellow in the History and Philosophy of Science at the Institute for Philosophy in Public Life.

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Workshop Summary

A “How-to” Guide for Developing a Publishable Scholarship of Teaching and Learning Project

Presented by: Valerie D. O’Loughlin

Reviewed and summarized by Ann C. Raddant
Assistant Professor of Biology, St. Ambrose University, Davenport, IA

For anyone interested in pedagogical research, the HAPS Annual Conference saved one of the best workshops for last. This workshop was directly related to the 2013-2015 HAPS President’s Initiative: Expanding A&P Education Research in HAPS. In addition, participants in Val’s HAPS-I course, “Introduction to Educational Research Methods”, attended the workshop as a portion of the course content.

In addition to providing a step-by-step outline of how to get an educational research program up and running, participants were given the opportunity to brainstorm during strategically placed “pause and reflect” sessions. The brainstorming sessions were the perfect time to start, or continue developing, a research question and begin to iron out the details. As a student enrolled in the HAPS-I course, I found that bouncing ideas off of other HAPsters was incredibly helpful for drafting my own educational research proposal. I was especially fortunate to have a senior colleague and collaborator from my own institute in attendance at the workshop. We talked very specifically about our research question and began to identify resources on our campus and within HAPS to help us put our plan into action.

I have summarized the main steps required for developing a Scholarship of Teaching and Learning (SoTL) research project below. For more details, see Val’s 2006 article in Advances in Physiology Education.

Research Question Development

One of the toughest parts of formulating a SoTL research program is deciding what exactly to research. The HAPS Annual Conference brings up so many interesting, innovative pedagogical ideas that are seemingly begging to be tested. Before changes are made to courses and student data can be analyzed, a research question must first be developed. The question should be clearly defined and include specific information about the parameters that will be measured as well as the setting of the research.

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Educational Research Literature
Ideally, a SoTL research project should break some new pedagogical ground and not simply replicate a previously published study. In addition to searching through A&P specific resources like the HAPS-Educator, Anatomical Sciences Education, and Advances in Physiology Education (all open access or available through a HAPS membership), be sure to investigate publications from other fields. Folks in engineering, chemistry, or even the liberal arts may have already tried the teaching method you are curious to investigate. Librarians are often especially helpful for locating useful articles during the literature review process.

Assessment Methods
The assessment methods to be employed in a pedagogical research study will be driven by the type of research question(s) being asked. A single study may even use more than one type of assessment; for example, both quantitative and qualitative processes may be used to assess how an intervention affects student learning outcomes as well as how students react to the intervention. No matter what type of assessment is being performed, it must be both reliable and valid; that is, it must give consistent results and must truly measure the parameter it is intending to measure. Another important consideration is what types of statistics will be used to analyze the data once it has been gathered. It is wise to consult with a statistician before beginning a research study in order to be able to draw meaningful conclusions from the data.

IRB Approval
Do not forget to get approval from your local Institutional Review Board (IRB) before beginning your study. Student are humans (easy to forget towards the end of any typical semester), which makes pedagogical research human subjects research. Many SoTL projects will fall under the “exempt” category, which does not mean you do not need approval; it simply means the project will not require a full-length committee review.

Perform Research
Finally, the fun part! Once a research question has been developed, assessment methods have been chosen and validated, and the project has approval from the local IRB, it is time to put the plan into action. Keep in mind that you may need to make small alterations as the course unfolds. Also, be sure to identify resources on campus that may be useful as you put your plan into action, such as your local Center for Teaching and Learning.

Analyze and Publish Data
The specific analyses to be performed will vary depending on the assessment strategies used. Val suggests analyzing data after the course is over and final grades have been assigned. Results can be published in a journal or at a meeting. Hopefully we will see some great workshops in Atlanta highlighting pedagogical research that was inspired by the 2015 HAPS Conference!

Reference

About the Author
Ann Raddant has been teaching anatomy and physiology to undergraduates and physician assistant students at St. Ambrose University for a year and a half. She was a first-timer at the 2015 HAPS Conference in San Antonio, Texas and a student in Valerie O’Loughlin’s HAPS-Institute course.

raddantann@sau.edu
Workshop Summary

“Express it and guess it”: A word game to review anatomy and physiology terms

Dr. Kathy Burleson
Hamline University

Reviewed and summarized by Zoë Soon
University of British Columbia Okanagan

Kathy introduced us to the idea of creating a vocabulary board game. This activity definitely became a “why didn’t I think of that?” moment, especially given all the new terminology students encounter in Anatomy and Physiology classes. As background material, Kathy recommends an article entitled “Learning can be all Fun and Games: Constructing and Utilizing a Biology Taboo Wiktionary to Enhance Student Learning in an Introductory Biology Course” (Olimpo et al. 2010).

After attempting to design a game based on Scattegories or Taboo, Kathy settled on creating an Anatomy and Physiology version of Funglish by Hasbro. In her game, students are grouped into groups of four and each group is given:

i) an envelope full of clue words
ii) game cards that contain vocabulary words that one of the students will try to guess.

A board that has been divided into three horizontal sections is placed on a table. Each of the three horizontal sections of the board has a heading labelled either Definitely, Kind-of, or Not.

Three students in each group secretly look at the vocabulary word on the game card. These three students place clue words under each heading on the board to accurately describe that vocabulary word. The fourth student tries to guess the word within the allotted time. For example, if the vocabulary word is “myosin”, the clue words placed under the Definitely heading might be: muscular system and protein. Clue words placed under the Kind-of heading might be active, fast, and thick. Clue words placed under the Not heading might be pointy or cortical.

Producing clue words is likely to be the most challenging part of developing this game. In order to generate as many clue words as possible, Kathy enlisted the students’ help as they played the game together and she also included blank papers so that they could write down new words as they thought of them. The clue words might include: adjectives, descriptors, definitions, origins, causes, signs, symptoms, blood test results, urine test results, treatments, prognoses, possible complications, and “seek medical care when....” scenarios.

Kathy made a new game for each unit she taught and used the game as a review activity. She had 30 students in her class and found that overall, the students found the games to be helpful. However, this activity can become a bit repetitive by the time every member of the class has had a chance to be the “guesser”, especially if the same vocabulary words are used over and over again. A colleague suggested that it might be possible to vary the game and perhaps make it more challenging by having the student locate each tissue on a diagram or model as well as identify the correct vocabulary word.

Going forward, Kathy is interested in assessing the usefulness of practicing terminology in this manner and she would like to create a pre-test and post-test for this activity.

Thanks to Kathy for sharing these wonderful ideas!

Reference cited:

About the Author

Zoe Soon has been an Instructor in the School of Health and Exercise Sciences, Faculty of Health and Social Development, University of British Columbia, Okanagan, Canada since July of 2011. She holds patents in elemental analysis of tagged biologically active materials and high-throughput screening of metabolic disorders using a laser desorption ion source coupled to a mass analyzer. Her areas of expertise include skeletal and cardiac muscle cell biology and pathophysiology.

Zoe Soon
Creating novel, engaging, hands-on activities and demonstrations for students is always challenging and Jeanine Page has developed several student-tested and approved activities that are both fun and educational and would work well, especially in smaller classes.

1. Boyles Law: This activity requires two different sized balloons, one regular-sized balloon and one big party-sized punching-balloon. Blow up both balloons, using the same amount of air; for example two breaths in each balloon. Pass the balloons around and ask the question, “Which balloon contains the highest air pressure?” This is a great tool for starting the discussion about volume and pressure relationships.

2. Blood: Antigens versus Antibodies: This activity involves role-playing. Students portraying erythrocytes are given combinations of labelled antigen flags representing A, B, and Rh antigens. In the first part of the activity, these blood-cell students can be organized to depict all eight blood types. Other students, who are assuming the role of antibody, are given labelled flags representing anti-A antibody, anti-B antibody and anti-Rh antibody. The antibody flags are designed to fit like puzzle pieces with the correct antigen flag. Students can then simulate the blood types again, with blood cells and appropriate plasma antibodies grouped together. In a subsequent scenario, students can act out agglutination.

3. Blood Pressure Effects: This is a matching game. In preparation for this game many strips of paper are prepared depicting events that occur either as a result of, or as a cause of, high blood pressure or low blood pressure. Examples of events that might appear on the paper strips are the release of antiuretic hormone (ADH), the release of aldosterone, and the constriction of the afferent arteriole. The strips are placed in an envelope and one envelope is given to each group of participating students. Each group of students works together to sort through the strips of paper and put together the correct sequence of events that match a scenario given by the instructor. For example, the instructor’s directions might be, “Find all of the events that will take place after the carotid baroreceptors detect high blood pressure.”

4. Balance Demonstration of Blood Buffering and pH: In this demonstration, Jeanine has created a set of two balances that work together linked with string to suspend three containers. From left to right, the containers are labelled: CO$_2$ + H$_2$O, H$_2$CO$_3$, and H$^+$ + HCO$_3^-$. This provides a means of demonstrating how the reactants for blood buffering and pH are in equilibrium with the products. Jeanine uses pennies to simulate the number of molecules and students can predict and then simulate how many pennies to put in each container for equilibrium to occur. Students are able to observe that when there are more pennies in the H$^+$ + HCO$_3^-$ container, this container drops down as does the pH of the solution. Students can visualize that increasing the number of H$^+$ ions invariably leads to a lower level of pH value, which is emphasized as the bucket descends with the weight of all the H$^+$ pennies!
5. Circulation: This a role-playing game in which students act out the roles of the four chambers and the four valves of the heart. A conference attendee suggested that this activity could be varied by having participating students play the role of red blood cells and walk through a giant heart drawn on chart paper on the floor. This idea was further elaborated on, with the suggestion that students wear red or blue labels as they walk through the appropriate chamber, to indicate whether they are carrying oxygenated hemoglobin or oxygen depleted hemoglobin.

6. Dr. Page Says: This game is reminiscent of the children’s game Simon Says, in which anatomical and directional terminology is employed and practiced.

7. Human Bilayer: Create a plasma membrane by enlisting 10 or more students to be phospholipids. Participating students face a partner and reach out towards their partner using their arms as the two fatty acid tails. More students can be inserted into the membrane in the roles of transmembrane proteins, channel proteins, cholesterol, and any other plasma membrane components that your students can think of. Movement among the membrane parts will demonstrate the fluidity of the model.

8. Human Depolarization Wave: This is another great role-playing game that allows the students to line up on next to each other and “do the wave” to simulate an action potential.

9. Muscle Contraction Steps: This is an activity adopted from a previous HAPS conference and is similar to the Blood Pressure Effects activity (activity number 3). Teams receive envelopes containing strips of paper, each one listing one step of muscle contraction. Teams race to place all the strips in their correct order. If this activity becomes successful for you, consider laminating the strips for re-use from year to year. Another topic that Jeanine covers in this manner are the sequential steps in aerobic and anaerobic cellular respiration.

10. Human Sarcomere: This is a role-playing activity in which all of the components of the sarcomere can be discussed and then seen in action.

11. Working Lungs: This activity is an oldie but goodie. Use tubing and balloons in a soda-pop bottle to demonstrate inspiration and expiration. This simple model really allows the students to see how differences in volume and air pressure assist air-flow during respiration.

12. Working Nephron: Jeanine created a tube system which includes the afferent arteriole, glomerulus, efferent arteriole, proximal convoluted tubule (PCT), Loop of Henle (LH), distal convoluted tubule (DCT) and collecting duct. This tube system contains a pump that she uses to pump water through the entire system. She overlaid this system on a backdrop of red, white and yellow. The arteriole tubing was placed over the red portion, the glomerulus was placed over the white portion and the PCT, LH and DCT were placed over the yellow portion.

13. Layers of the Skin: In order to really understand and fully grasp the differences of each layer of skin, Jeanine generated the following worksheet for her students to get them involved in their own learning.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Location</th>
<th>Function/Description</th>
<th>What is unique about this layer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidermis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corneum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lucidum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granulosum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinosum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dermis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papillary Layer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reticular Layer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypodermis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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14. My Very Unfortunate Aunt: In this lesson, Jeanine suggests using one of your own family members or acquaintances that have a real-life affliction to present an actual case study and use that information to help teach a particular topic. This situates a physiological process or dysfunction within a real person, allows students to possibly make an emotional connection with that person, and illustrates the importance of understanding the basic science behind a disease.

15. Worksheets: How to address the question: What’s on the exam? The last idea, Jeanine presented was the idea of generating worksheets, similar to the one shown in activity number 13, instead of study-guides. This made me think of Dr. Van Meter’s update session, in which she noted that Self Explanation and Direct Response tasks helped students to understand the topic in a deeper manner and perform better on exams.

Jeanine’s workshop was a source of many fun and interesting tools that will undoubtedly be memoralbe to the participants. Jeanine has great ideas that deepen learning, encourage peer teaching and learning, stoke curiosity, and at the end of the day generate a warm, safe, collegial learning environment. Thank you Jeanine! To see more of Jeanine’s ideas and inspirations see her work on the Life Science Teaching Resource Community (LifeSciTRC).

**Photos are included with the permission of Dr. Jeanine Page.

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**About the Author**

Zoe Soon has been an Instructor in the School of Health and Exercise Sciences, Faculty of Health and Social Development, University of British Columbia, Okanagan, Canada since July of 2011. She holds patents in elemental analysis of tagged biologically active materials and high-throughput screening of metabolic disorders using a laser desorption ion source coupled to a mass analyzer. Her areas of expertise include skeletal and cardiac muscle cell biology and pathophysiology.

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**2016 Conference Candids**

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Workshop Summary

The State of Online Anatomy & Physiology Lecture/Lab Course Delivery: Are We Ready for Prime Time?

Presented by: Ewa Gorski¹, Ellen Lathrop-Davis¹, Tom Lehman², Robert Leopard³, Betsy Ott⁴, and Shari Litch Gray⁵,

¹CCBC-Catonsville, ²Coconino Community College, ³Monroe Community College, ⁴Tyler Junior College, ⁵Regis College

Reviewed and summarized by Shari Litch Gray, Regis College

This workshop, designed as an open forum, assembled a panel of online practitioners whose experience ranged from those who were just preparing to teach online anatomy and physiology for the first time in the fall of 2015 to those with a decade or more of experience in teaching online anatomy and physiology courses.

The workshop opened with the panelists introducing themselves as follows:

TOM LEHMAN ------------------------
I have been teaching a variety of biology courses, including anatomy and physiology, at community colleges in Colorado and Arizona for seventeen years. All of my courses have been taught face-to-face, but I have worked with distance delivery courses, developed supplemental online courses for my classes, and served on a statewide committee in Colorado that researched online science labs. I am excited to share what I have learned and discover what others have to share in this panel discussion. Tom Lehman, Coconino Community College, tom.lehman@COCONINO.edu

ELLEN LATHROP-DAVIS --------------
My master’s degree is in aquatic ecology but anatomy and physiology instruction was what the community college I applied to needed so I taught myself anatomy and physiology as I taught my students. I have been teaching full time at the Community College of Baltimore County since 2000 and I have taken several of the HAPS-I courses over the years. I started teaching a hybrid A&P II course with an online lecture and added A&P I to my teaching schedule in 2004. I am familiar with Quality Matters standards and will be revising my courses next year to meet those standards. Ellen Lathrop-Davis, CCBC-Catonsville, elathrop@ccbcmd.edu

EWA GORSKI -----------------------
My PhD is in Human Physiology. I teach human anatomy and physiology, lecture and lab, as a prerequisite for the nursing program, and physiological pathology for the Mortuary Science program at Community College of Baltimore County in Maryland. I developed my first online hybrid A&P I course in 2002, and I have been teaching physiological pathology online since 2010. Ewa Gorski, CCBC-Catonsville, egorski@ccbcmd.edu

ROBERT LEOPARD -------------------
My master’s degree is in field biology, which is what I had originally planned to teach. Over the years, I have taught at two universities and four community colleges and I currently teach at Monroe Community College in Rochester New York. I was asked to teach anatomy and physiology over ten years ago and anatomy and physiology has been almost my entire teaching load since that time. I would have taught it long ago if I had known how much fun it was. I started teaching anatomy and physiology online in 2004 and I have observed that online courses and online students have changed a lot since then. Robert Leopard, Monroe Community College, rleopard@monroecc.edu

BETSY OTT -------------------------
My PhD is in Forestry and my MS is in physiological ecology. I taught physiology, lecture and lab, for nursing, animal science, and pre-pharmacy majors at Auburn University in the early 1980’s before moving to Texas. I have taught anatomy and physiology at Tyler Junior College since 1982, with an occasional summer job in physiology lecture at the local university. I developed the first online biology courses at TJC (lecture only) and I am currently teaching online anatomy and

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physiology lecture courses. I have developed online resources for all the anatomy and physiology students, including videos, animations, quizzes, and flash cards. I also teach hybrid anatomy and physiology sections, in which class time is used to analyze problems rather than to deliver lectures. Betsy Ott, Tyler Junior College, bott@tjc.edu

SHARI LITCH GRAY -------------------

I have a PhD in Reproductive Physiology and I spent six years after graduate school as the lab director for an IVF program in Boston. I have been teaching anatomy and physiology for allied health undergraduates (Nursing, Radiology, Pre-Med/Vet etc...) and graduate students (PT, PA, Biomedical Science) for 20 years, so I remember when state of the art in lecture presentation was overhead acetates. My college, Regis, is an Apple Distinguished Institution and every student has an iPad so there is a great emphasis on moving content, and entire courses, to an online format. I was charged this past year with designing a two-semester online anatomy and physiology course, with a lab sequence, which is scheduled to begin in Fall 2015. My year of research and planning for this course has been amazing and I feel I have investigated and selected many best practices for transitioning anatomy and physiology from face-to-face to online delivery. However, I have not yet taught the course so I can only hope that my selections will produce an educational experience that mirrors that of a face-to-face course as closely as possible. Shari Litch Gray, Regis College, shari.gray@regiscollege.edu

I served as the facilitator for the panel and I posed the following questions to the panelists. Ample time was allowed for contributions and questions from the audience.

What is your favorite online/hybrid best practice?

- Betsy – I give an online anonymous survey mid-semester to check-in with students.
- Ellen – I pool questions in a quiz form and randomly give quizzes to students. Students are allowed to take the quiz three times with different questions.
- Robert – I ask students to write a final letter to the next class as a means of building community.
- Tom – I give practice quizzes and I have found this to be very helpful.
- Ewa – I post recordings and answers for activities in a timely manner, usually by end of week in which such activity takes place.
- Shari – I use the Discussion Board to have students post questions from weekly readings that they found difficult. Classmates must respond with their answers to these postings.

What is something that didn’t work well or something you would change?

- Betsy – I have found that open-ended grading questions don’t always work well. Be sure to give some assignment options since not every student will like everything.
- Ellen – It is necessary to be clear on citing requirements. If the requirements are ambiguous students will follow many formats. Don’t make video recordings too long.
- Robert – It is best to reduce the number of Discussion Boards since they are very time-consuming. Require that a picture of the textbook and a photo ID (usually driver’s license) be sent to the instructor to document that students have purchased the textbook.
- Tom – I have found that students often don’t read the syllabus so I find it helpful to mandate a syllabus quiz.
- Ewa – I have found that on-campus review sessions for online students do not work well. There is very low attendance for these sessions.

Can lab be done well online? What are some Recommendations?

- Betsy – If possible, mandate that students come on campus for lab sessions.
- Robert – I have found that smaller lab sections work better. With respect to the issue of cheating on lab (or lecture) exams, use proctoring services or have students travel to a designated proctor site.
- Ewa – I suggest having the lab exams on campus and checking student photo IDs.
- Shari – I require students to take photos of themselves performing the steps of a procedure. For example, if the lab includes using a commercially prepared and delivered dissection specimen, ask students to video themselves explaining the locations of required structures.

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Audience participation in this workshop was high and many questions centered around issues of monitoring student honesty. The panel members agreed that cheating attempts are inevitable in both online and face-to-face classes. Suggestions from the panel on fostering honesty included requiring photo ID’s to accompany submissions, limiting time for online multiple choice quizzes/exams and using available proctoring services, although proctoring services can be pricey.

The consensus of the group is that the interest in an online delivery mode for anatomy and physiology courses and other courses is growing. Many institutions are feeling the need to include online instruction as an option for some, if not all, students, depending on the degree track. There are many superb examples of online anatomy and physiology instruction, both lecture and laboratory, as exemplified by the panelists of this workshop. For those considering teaching an online anatomy and physiology course the panel recommends doing the appropriate research into available modes of instruction and designing the course to fit the needs of your students and the instructor. HAPS has a Distance Learning Position Statement available on the website and this is an excellent place to begin your research. Please feel free to contact any of the panelists of this workshop for help or suggestions.

About the Author

Shari Litch Gray is a Reproductive Physiologist by training and she has been teaching anatomy and physiology to allied health care undergraduates for twenty years. Regis College is a four-year liberal arts institution with a strong nursing program preparing students for BS, MS and DNP degrees. Shari’s passion is to improve her teaching of anatomy and physiology and other areas of biology and to share her experiences with her colleagues. Shari Litch Gray, PhD, Regis College
shari.gray@regiscollege.edu

2016 Conference Candids
Workshop Summary

Using the Life Sciences Teaching Resource Community (LifeSciTRC) to Support Vision and Change and Next Generation Science Standards Evidenced-Based Teaching

Miranda Byse, American Physiological Society
Julie Dais, Okanagan College

Reviewed and summarized by Julie Dais
Okanagan College

The Life Science Teaching Resource Community (LifeSciTRC) is a life-sciences-educator online community which includes a searchable collection of digital resources as well as blogs, discussion boards and announcements. If you are familiar with the LifeSciTRC, perhaps your first exposure to it was at the American Physiological Society booth at a HAPS conference, or maybe you have seen advertisements in journals such as this, or maybe you caught Miranda Byse’s presentation during the new Synapse-HAPS event at this year’s annual Conference in San Antonio, TX. Miranda is the Program Manager for the LifeSciTRC, and was one of seven presenters who each gave back-to-back, 5-minute talks accompanying auto-advancing slides. If you are not familiar with LifeSciTRC, you might recognize the LifeSciTRC’s previous name, the APS Archive of Teaching Resources. The name change was a result of community building efforts and the addition of several new partners as part of an NSF grant (DUE-1043878).

The idea for a hands-on HAPS workshop to introduce educators to the website was hatched at the stakeholders’ meeting in January of 2015 where LifeSciTRC Scholars and Fellows were asked to help determine the future direction of the LifeSciTRC. It was suggested that we could engage more educators through hands-on introductions to the website. I volunteered to present a workshop, in conjunction with Miranda, at the HAPS 2015 Annual Conference in San Antonio, TX where I could demonstrate how I utilize the various resources available on the LifeSciTRC in my courses.

About 20 participants attended the workshop in a computer lab at the downtown campus of the University of Texas, San Antonio. Miranda began with a general overview of the LifeSciTRC (Byse, 2014) and then together we assisted participants in signing up with the site. We emphasized the importance of adding details to the member profile, such as selecting teaching areas, in order for the LifeSciTRC home page to present customized resource recommendations, forums, and blogs.

Once everyone was “in” I demonstrated how I narrowed my search for information by using the drill down listing and advanced search features. For example, I could search for resources related to the respiratory system specific for the lab, or a particular grade level, or further narrow the search for a video or case study.

If a search resulted in many great resources, but there wasn’t time to examine them all, I showed how a search could be saved. Resources can also be organized into folders, and I demonstrated how to create new folders...
and save resources to multiple folders (i.e. laboratory, lecture, particular topic, simulations, data analysis, etc.). With this built-in folder feature, you do not need to save any resources to your computer plus you can access the resources from any computer. Participants learned how to create folders and practiced saving resources they wished to view in the future. Folders can be submitted to the LifeSciTRC collection along with a description of how the included resources could be used by educators. I showed the group a folder I created consisting of a variety of lung structure and function activities for the use in student labs. (http://www.lifescitrc.org/collection.cfm?collectionID=2989).

One of the most amazing aspects of the LifeSciTRC resource collection is that members can rate resources and comment on them as well. I pointed out that when a search results in many hits but a particular resource has received a number of 5 star ratings (highest), I will examine it first. This way community members can help each other sift through the thousands of resources in the collection with the best quality and most useful ones rising to the top of the list. I showed examples of comments made by community members and demonstrated how easy it is to leave comments of your own. (Note: all comments are reviewed by LifeSciTRC staff before becoming public.)

We ended the workshop by encouraging participants to submit their own resources or submit links to the LifeSciTRC. Anyone interested in doing this can email Miranda at mbyse@the-aps.org.

If you did not attend the workshop, but are interested in becoming a member of the Life Science Teaching Resource Community please take the plunge and sign up! Create your profile and start playing. Training videos are available if you wish to learn about the various features of the LifeSciTRC this way. (https://www.youtube.com/channel/UCAo5-8rlDdnH9eTPHqwYGAA).

Resources

About the Author
Julie Dais teaches anatomy and physiology as well as pathophysiology and general biology at Okanagan College in beautiful British Columbia. As part of her goal to “flip” her classes, she discovered the Life Science Teaching Resource Community and in the process has become a LifeSciTRC Scholar, Fellow, content reviewer, and blogger.

■
Workshop Summary

What Type of Learner Are You?
Learning Styles of Undergraduate Gross Anatomy Students

Presented by: Melissa Marie Quinn and Jennifer Marie Burgoon

Accounting for individual learning styles is not a new idea. As early as 334 BC, Aristotle said that "each child possessed specific talents and skills" and he noticed individual differences in young children (Cambiano et al. 2001). Accordingly, it is no surprise to learn that students learn and process information in many different ways. There have been numerous research studies on learning styles and, therefore, there are copious definitions, theoretical positions, tools, instruments, and interpretations from which learning styles can be defined, classified, and identified. One such instrument is the Index of Learning Styles (ILS) questionnaire developed for engineering students by Drs. Richard Felder and Barbara Soloman in 1988 at North Carolina State University. The ILS questionnaire was the focus of the "What Type of Learner Are You? Learning Styles of Undergraduate Gross Anatomy Students" workshop presented at the 2015 HAPS Conference. During this workshop, the ILS questionnaire was presented and discussed, along with its current and potential utilization within the field of Anatomy education.

The ILS questionnaire consists of 44 questions that encompass the four dimensions of learning styles. There are exactly eleven questions tied to each dimension in order to provide a rounded assessment of what sub-dimension a participant prefers. Participants complete each question by choosing one of two options representing opposite ends of one of the learning styles sub-dimensions (Litzinger et al. 2007).

After calculating an individual’s score for each of the dimensions, one can determine where, on a continuum, an individual is classified. If a participant’s score falls between one through three, they are fairly well balanced between the two dimensions of that learning style. If a participant’s score falls between five through seven, they have a moderate preference for one of the dimensions of that learning style. If a participant’s score falls between nine through eleven, they have a very strong preference for one dimension of that learning style (Felder and Silverman 1988).

Attendees at the workshop were presented with the ILS questionnaire and had the opportunity to complete and score the ILS questionnaire themselves, as well as discuss the different ways it can be used in their classrooms. Some of the data from a study currently being conducted at The Ohio State University-Columbus Campus, using the ILS questionnaire, was presented during the workshop, specifically the data indicating the preferred learning styles of undergraduate anatomy students. Students in a large enrollment (approximately 575 students) undergraduate human anatomy course held during the Spring 2015 semester completed the ILS questionnaire and were given their personalized results, along with a handout of study tips for the different learning styles. For the 505 students who consented to participate in the study, 277 (54.9%) were found to be active learners, while 228 (45.1%) were found to be reflective learners in the active/reflective (ACT/REF) dimension. For the sensing/intuitive (SEN/INT) dimension, 430 (85.1%) were found to be sensing learners, while 75 (14.9%) were found to be intuitive learners. In the visual/verbal (VIS/VER) dimension, 410 (81.2%) were found to be visual learners, while 95 (18.8%) were found to be...
For the sequential/global (SEQ/GLO) dimension, 377 (74.7%) were found to be sequential learners, while 128 (25.3%) were found to be global learners. This data falls in line with previous research in other academic fields such as engineering, biology, business, and health sciences.

Overall, it was a very successful workshop that brought about a good exchange of ideas and collegial debate that, in the end, will hopefully lead to a better understanding of students and their learning styles. Anyone interested in receiving the PowerPoint file from this presentation and/or has questions may contact either presenter/author via email, Melissa Marie Quinn (quinn.269@osu.edu) or Jennifer Marie Burgoon (jennifer.burgoon@osumc.edu). Anyone interested in using the ILS questionnaire in their classroom and/or while conducting research, please contact Dr. Richard Felder, rmfelder@mindspring.com.

Literature Cited from Article/Presentation:

About the Authors

Melissa Quinn is currently getting ready to defend her dissertation, entitled Learning Styles of Undergraduate Students and its Influence on the Preference of Lecture Delivery Method in a Large Enrollment Undergraduate Gross Anatomy Course, for her PhD in Anatomy at The Ohio State University. She is involved in educational research in Anatomy specifically with respect to lecture delivery methods and learning styles. Melissa has been a Graduate Teaching Associate for the Division of Anatomy since 2012 and has she multiple teaching responsibilities in the division. Her primary teaching role is lecturing to the undergraduate anatomy classes as well as working with medical, dental, and professional students.

Dr. Jennifer Burgoon has been an Assistant Professor - Clinical in the Division of Anatomy in the College of Medicine at The Ohio State University, Columbus Campus, since August 2008. She earned her MS in Cell Biology and Anatomy in 2001 and her PhD in Educational Psychology, Measurement, and Evaluation in 2008, both from University of North Carolina, Chapel Hill. She is the course director and/or instructor for a number of the large undergraduate anatomy courses offered by the division, which serves over 1600 undergraduate students per year. She also teaches histology to dental, medical, and graduate students, as well as leading a teaching seminar for the anatomy graduate students. Her research focuses on the anatomical self-efficacy of medical students and developing teaching resources, as well as examining the role of undergraduate anatomy education in the preparation of students for professional programs.
Engaging First-Timers with Target Activities

Ron Gerrits, PhD.
Biomedical Engineering at Milwaukee School of Engineering

Volunteers are critical to the function and success of HAPS as an organization. They compose the Board of Directors, Steering Committee (the Chairs of the various HAPS committees), and committee members. Without them the society simply wouldn’t exist.

One way that HAPS attempts to engage members in the society is through a variety of “first-timer” activities at the annual conference. These activities are aimed at providing a welcoming feeling and an opportunity to meet with past and present leaders of HAPS.

First-time attendees receive a black ribbon for their name badge, making them easily identifiable to the other members. The HAPS leadership makes a special effort to talk with first-timers and ask about their conference experience. Specific first-timer activities include a breakfast and leadership scavenger hunt. At the plated breakfast, first-time attendees are seated with at least one past-president of the organization and possibly a committee chair. At this event they learn about the history and direction of HAPS as an organization.

The leadership scavenger hunt involves first-timers obtaining signatures from HAPS committee chairs, the Executive Director and the incoming President. During these encounters discussion often occurs related to the role of each. Those members that obtain all signatures are entered in a drawing for the following year’s conference registration. If the participant identifies any committees they would like to learn more about, they indicate that on their scavenger hunt card for post-conference follow-up.

The extent to which such first-timer activities lead to engagement in the society has not been tracked, but there are many examples of first-timers becoming active members of committees over the next year. From my own personal experience, I still fondly recall how well I felt treated as a first-timer over twelve years ago. In fact, I am tempted to ask for a first-timers ribbon every year.

About the Author

Ron Gerrits is a Professor of Biomedical Engineering at Milwaukee School of Engineering, where he mainly teaches physiology, pathophysiology and related courses. He has been a HAPS member since 2002. He has served two terms as chair of the Curriculum and Instruction committee and is currently chair of the Steering committee.
A First Timer Experience

Anya Goldina, PhD.
Elizabethtown College, Elizabethtown, PA

I stepped into my first Anatomy and Physiology course as an instructor two years ago. Up until that point I had taken physiology courses as an undergraduate student and I had done work in physiology while working on my dissertation, but I had NEVER taken a course in Anatomy. On my first day of class, I stood in front my students and felt my knees and voice tremble. Some common advice to people giving presentations is to imagine that the audience is naked. In my case, I felt naked. My lack of confidence and nervousness were blatantly on display for all to see. I was excited about taking on the challenge of teaching this fascinating topic, but I was also incredibly intimidated by the sheer amount of information I needed to retain and convey to my students!

This was two years ago. I am now more excited than nervous, know more anatomy and physiology, and also feel much more comfortable telling my students “That’s a great question, and I don’t know the answer. But I will find out!” I have developed thicker skin protected by layers of skills such as effective class management techniques, cool interactive activities, and most importantly, an incredible support network of HAPS members. In fact, it is the HAPS members and the HAPS listserv that helped me grow and refine my teaching philosophy during my first two years. Needless to say, as soon as I learned about the HAPS conference at San Antonio, I knew that I must attend! I was thrilled to receive the Contingency Faculty Scholarship to attend the conference.

The conference was an incredible experience. I have attended many professional meetings before, but none as welcoming, friendly, and enthusiastic as HAPS. I loved the idea of a first-timer’s breakfast and a treasure hunt as an opportunity to meet all the committee chairs. Most importantly, I learned so much from the multiple workshops and conference speakers. In my lectures, I use power points that mainly consist of diagrams (very little actual text) and I require that my students learn to develop diagrams and concept maps to integrate the physiological systems we cover. Therefore, I was surprised to learn from Peggy Van Meter’s data, in the “Visualizations and the College Anatomy and Physiology Student: How Instructional Practice Can Support Learning” seminar that most students don’t know how to read and interpret the figures in their textbooks. What I assumed to be an obvious and easy skill that I could build upon in my lectures, might have been preventing my students from being able to follow me in lectures and providing them with unnecessary anxiety. I am now reworking my lectures to incorporate activities for students to learn how to interpret and work with diagrams in their text, as well as how to create their own. I will also no longer be implicit about the importance of knowing how to read the textbook. As Peggy stated, I will “put the points where values are,” by creating and rewarding activities that reinforce diagram comprehension. Furthermore, Vasilii Kolchenko’s workshop on pictograms, “Graphic Representation in Undergraduate Anatomy and Physiology: Less is More?” gave me new tools to incorporate into my diagram assignments.

continued on next page
The workshop “The musculated skeleton” by Thomas Lanthorn and the poster “The Effectiveness of Using Yoga Asanas to Teach Musculoskeletal Anatomy to Undergraduate Students” by Mackenzie Loyet and Barbie Klein also gave me great strategies to help students connect function to structure when learning the musculoskeletal system. I anticipate that my students, physical therapy and occupational therapy majors, will really enjoy these hands-on activities. I also loved playing with the Maniken system and will try adding “build your own muscles” exercise to the musculoskeletal activity sequence.

Ultimately, my first HAPS conference was an experience that I can’t wait to repeat. I am amazed how much I learned and how many incredible people I met. I wish I could have attended more workshops, or had a body-double to be at multiple workshops at the same time. There is not enough space here to cover how each event, workshop, and poster impacted what I will do in the classroom and how I approach anatomy and physiology. As I sit in my office preparing for the Fall semester, I keep reviewing my notes from the conference making sure that every class lecture and activity have clearly defined goals, use clear visuals and exciting examples that lead to “more Aha” and a lot less “Blah, Blah” moments. I am working to make sure that my course accomplishes my personal goal: to inspire students to care about science and give them confidence to be life-long learners, kind of like what the HAPS Conference did for me!

I can’t wait until next year!

goldinaa@etown.edu

2016 Conference Candids

About the Author

Anya Goldina is originally from the Ukraine. She has taught anatomy and physiology and general biology at Elizabethtown College in Pennsylvania since 2012. She enjoys teaching and the challenge of learning effective ways to teach anatomy and physiology. When she is not working, she enjoys spending time with her daughter, traveling, hiking and exploring ethnic foods.
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... and the many “Fun Runners”
EDU-Snippets: Summer 2015
Sense-ual Snippets

EDU-Snippets – A column that survives because you - the members - send in your Snippets

Roberta M. Meehan
GMU
Phoenix, AZ
Edu-Snippets@hapsconnect.org

EDU-Snippets is a column designed to let you, the members of HAPS, share your “ways to make sure your students get it.” Since EDU-Snippets began, our members have been continuously amazed at how many teaching and demonstration ideas pop up and are easily transferred from one instructor to another through Snippets. This edition is no exception. So, our topic for this issue is Sense-ual Snippets. Hopefully you will be able to utilize what our colleagues have submitted. Hopefully, too, some of the ideas presented here will spur you on so that you can either make alterations to fit your own needs or spark your imagination so that you can come up with your own Snippet ideas, which you can then submit for publication.

I. Conference Inspired Snippets

A. Direct Inspiration

Janice Fritz (St. Clair County Community College, jfritz@sc4.edu) came up with a great idea after the Conference. Maybe it would be better to say that a number of points all came together for Janice. As Janice says...

I was inspired by several of the conference speakers to add a new type of activity to my repertoire. After considering the visual literacy of my students in light of Peggy VanMeter’s update seminar and the cognitive level of my typical activities using Janet Casagrande’s method for “Blooming” questions, along with an appreciation of the extra classroom time I have as a result of flipping my classroom, I have begun asking my students to create visual representations of the information provided in lecture videos.

For example, after hearing me talk about the mechanisms regulating salivation, I give them a drawing of a head and ask them to create a figure illustrating some aspect of salivation. In addition to involving a higher-level cognitive processing, the artistic presentation provides an opportunity to teach students how to integrate text and visual information.

This is a great activity for a flipped classroom because many students can repeat the information but struggle to represent it in a different modality. Peer discussion and instructor intervention in class keep the frustration from becoming overwhelming.

B. Indirect Inspiration

The Conference was held in San Antonio and who can think of San Antonio without thinking of the Alamo? While no specific Snippets dealing with the Alamo were submitted, there was a lively discussion on the HAPS-L list about using the Alamo itself as a teaching tool. For instance, consider cellular defenses, the immune system as a whole, the invasive diseases, and so forth.

II. Musical Snippet

Here’s an interesting and creative Snippet from (Mia Ray (Trinity Washington University, raym@trinitydc.edu).

Can music or poetry assist students in improving their understanding of key learning objectives in anatomy and physiology?

For the past few semesters I have assigned my students the task of creating poems or songs on cellular anatomy and components of the axial and appendicular skeleton in an attempt to answer just that.

In this assignment students were given three to four weeks to complete and memorize their work. They were encouraged to create simple poems or songs that would be easy to memorize.

continued on next page
When I compared the test performance on this subject matter to previous courses that were not given this assignment, I saw that students who completed the assignment showed increases in test performance on subject related questions. In addition, the test performance of students who did not complete the assignment were comparable to the performance of previous semesters.

All in all I saw that poetry and music in this case vivified student learning and creativity, as well as increased the comprehension and retention of information related to cellular and skeletal anatomy.

III. Fainting Snippet

Meanwhile, John Pellegrini (St. Catherine University, jpellgrini@stkate.edu) sent a very informative Snippet that perhaps we should all be aware of. We can certainly share this knowledge with the students.

At the beginning of the 70s television show Quincy M.E., the medical examiner gleefully smiles as he grosses out police cadets at an autopsy. Down go the young men in blue, passing out from disgust. My teenage self found it funny. Now that I teach anatomy and physiology, I don’t laugh. I’ve seen students hurt themselves as they faint and fall, the wooziness can become contagious in the room, and the whole experience is unsettling (perhaps as a reminder of mortality). Consequently there are two labs that I dread each year: the cadaver lab and the blood lab.

I give students many warnings, but I don’t think there is a way to completely prevent it. If you teach these labs to many students over many years, a few will pass out. Vasovagal syncope is the term given to this form of fainting. Vessels dilate, the vagus nerve signals the heart to slow down, and heart rate and blood pressure fall. The brain does not get enough oxygen, and so consciousness is lost. Why would the sight of blood or innards trigger this? It’s not clear. Some theorists argue that it’s a holdover from an adaptation to primitive warfare. When our ancestors passed out from seeing gory battle scenes, they effectively played dead, and adversaries passed them by. Another idea is that the response protects against excessive bleeding. When you see your own blood or bone, slowing the heart and lowering blood pressure might decrease the amount of blood that will flow through a wound before clotting occurs. I think about this type of fainting as a disgust response (pathogen avoidance through nausea) that just gets carried a bit too far.

But whatever its function is or was, syncope sure adds drama to my classroom. The victim often goes down quickly, without warning. Sometimes the student has jerky limb movements. There is a commotion as lab partners try to figure out what happened. Some classmates are unnerved and others step into the role of caregiver. I tend to have both reactions (not a great combination, I realize). A few students in the room seem blissfully unaffected and will surprise me with questions while I’m trying to administer first aid (“Do we need to know how to spell hematopoiesis for next week’s quiz?”).

In other instances, a student feels the nausea coming on gradually. When I see someone in lab looking pale and disgusted, I suggest that person sit on the floor for a little while, with the head between the knees. This has generally worked well, except for the time a student said she had recovered, and so I helped her up, hitting her head on the fire extinguisher that was mounted on the wall above her. These experiences leave me wondering many things. What exactly causes this type of fainting in certain people? What do our reactions to blood or to seeing someone faint say about empathy?

IV. Challenging Snippet

Have you ever been looking for a challenging question designed just to see how your students are thinking? A question with no absolute answer that can be used for any number of purposes from thought analysis to bonus points to extra credit to a semester’s challenge? Here’s one such question – and you are invited to submit your own so that EDU-Snippets can print them.

Some people say that humans are really aquatic animals that just happen to live on land. Using the (xxxx) system(s) of the body, explain why you agree or disagree with this statement. Be specific.

continued on next page
V. And We Hope You Will....

Keep those cards and letters coming (right to our Edu-Snippets@Hapsconnect.org address)! Thank you all for your EDU-Snippet contributions. The influx of Snippets has been good! Please keep it up because more are always needed! Your ideas are tremendous! If you have thoughts or ideas, or any other interesting ways – any inspirations at all, great or small – to help our students understand anatomy and physiology, EDU-Snippets would love to hear from you! Once again, EDU-Snippets encourages new submitters to submit – and regulars to keep on contributing! If you’ve got some Snippets, please share them with us. You will also find a reminder on the HAPS-L list. But, plan ahead. You can even submit your ideas now and maybe next issue you too will see your EDU-Snippet in print! Perhaps you even have a suggestion for a Snippet theme! If that sparks a challenge, send in a Snippet!!

Dr. Roberta Meehan is a semi-retired science educator presently involved in tutoring and professional writing. Among other literary endeavors, she has written 17 science books and manuals and two non-science books. She has also written for, edited, copy edited, and done various types of analyses for most of the major publishing houses. She has been on the HAPS Editorial Board for 14 years and has been involved with EDU-Snippets for almost that long. Roberta lives with her dachshunds in Phoenix, Arizona.

Current HAPS-I course offering

Rational Human Anatomy & Physiology Course Design: Incorporating the HAPS outcomes into new and existing courses.
(2 credits)
September 13 - November 2, 2015
Margaret A. Weck, D.A.
St. Louis College of Pharmacy

The course is briefly reviews the major concepts associated with the "backwards design" model of rational course development, which stresses the value of thinking through the ultimate outcome goals (both in content mastery and cognitive skill development) for a course as a first step the course design process. Participants will examine the HAPS Course Guidelines for Undergraduate Instruction and A&P Learning Outcome statements and think about the design elements, teaching methodologies, and assessments (both formative and summative) that would best foster student achievement of these outcomes. The course will be conducted entirely on-line. Participants will produce syllabi for new or existing courses that demonstrate the principles of rational course design. As part of this process sample assignments and assessments will also be developed that could be used in any course to demonstrate student achievement of the A&P Learning Outcomes.

Courses are continually added, watch our Facebook and Google+ pages for the latest course announcements!
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**ANIMAL USE**
Robert Tallitsch, Chair
This committee is charged with developing, reviewing, and recommending policies and position statements on the use of animals in college-level A&P instruction.
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**CADAVER USE**
Melissa Carroll, Chair
This committee is charged with developing, reviewing, and recommending policies and position statements on the use of cadavers for human anatomy and physiology education in colleges, universities and related institutions.
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**COMMUNICATION**
Wendy Riggs, Chair
This committee is tasked with helping HAPS establish its voice in a technological landscape shaped by social media. Committee members work closely with the Marketing Committee to facilitate connections within HAPS as well as recruiting potential members via social media.
wriggs@hapsconnect.org

**CONFERENCE**
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This committee actively encourages HAPS members to consider hosting an Annual Conference. We provide advice and assistance to members who are considering hosting an annual conference.
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**CURRICULUM AND INSTRUCTION**
Hiranya Roychowdhury, Chair
This committee develops and catalogs resources that aid in anatomy and physiology course development and instruction.
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This committee is responsible for publishing a quarterly edition of the HAPS-EDucator, the journal of the Human Anatomy and Physiology Society. The committee works closely with the Steering Committee and the President of HAPS.
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**HAPS INSTITUTE**
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HAPS Institute oversees a program that offers graduate biology credit courses earned through Alverno College
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**MEMBERSHIP**
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This committee is charged with expanding our membership base to include all Human Anatomy and Physiology educators or those individuals, institutions and corporations crucial to the HAPS mission statement of “Promoting Excellence in the Teaching of Human Anatomy and Physiology.”
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Neal Schmidt, Co-Chair
This committee develops standards for laboratory safety. The committee maintains a variety of safety documents available for download.
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**STEERING**
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This committee consists of all committee chairs. It coordinates activities among committees and represents the collective committee activity to the HAPS BOD.
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**TESTING**
Jennifer Burgoon, Co-Chair
Valerie O’Loughlin, Co-Chair
This committee has completed, tested and approved the HAPS Comprehensive Exam for Human A&P and is developing an on-line version of the exam.
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**2016 CONFERENCE COORDINATORS**
Kyla Ross, Co-Chair
Adam Decker, Co-Chair
The committee chairs invite input from HAPS members and willingly provide information on the activities of their committees.
kross@hapsconnect.org
adecker@hapsconnect.org

Click here to visit the HAPS committees webpage.
PRESENTATION ABSTRACTS

Tuesday, Session 1

101 (Room BV 3.306) – America vs. India: A Comprehensive Comparison of Issues and Challenges Faced in Migrating to a Digital Teaching and Learning Environment – 90 Minutes
William L. Hoover, Bunker Hill Community College, whoover@bhcc.mass.edu, Dennis Burke, Bunker Hill Community College, dburke@bhcc.mass.edu, Kaushik (Kash) Dutta, University of New England, kdutta@une.edu

As higher education becomes increasingly global, it is imperative we share our digital successes and failures with our international counterparts. Topics to be addressed in this presentation are: finding time to acclimate to technology, digital course creation, accreditation standards, WiFi access, faculty and student onboarding, user training and support, and publisher content limitations. Participants will actively engage in a roundtable discussion and Q & A session with both American professors and Indian professors (via a live Skype session).

102 (Room BV 3.318) – Teaching, Learning & Assessing Using a Conceptual Framework for Homeostasis – 90 Minutes
Jenny McFarland, Edmonds Community College, jmcfarla@email.edcc.edu, Ann Wright, Canisius College, wrighta@canisius.edu

Homeostasis is a core concept in physiology and an example of the “systems” Vision & Change core concept. Workshop participants will apply a validated conceptual framework for homeostasis to their teaching, student-centered learning activities and assessments. We will discuss the framework in the context of giving students deliberate practice with this concept and components of the framework throughout a course. Participants will use the framework to design formative assessments, and learn how to apply the feedback to a plan that provides recurring deliberate student practice. For multiple-choice feedback, we will address the importance of item (distractor) selection in formative assessment. Supported by NSF DUE-1043443.

103 (Room BV 3.324) – Andreas Vesalius: The Father of Modern Anatomy and Physiology – 90 Minutes
Mark Nielsen, University of Utah, marknielsen@bioscience.utah.edu

Five hundred years ago this past December 31st, in the wee hours of the morning, a young boy was born in Brussels. In a short span of 30 years he would not only revolutionize the science of anatomy, but completely change the tenor and practice of the biological and medical sciences. And while he will always be remembered for his incredible book, De Humani Corporis Fabrica, it is his courage, genius, and vision that are the real story behind this Renaissance man.

104 (Room BV 3.326) – Use Learning Catalytics™ to Experience Peer Instruction and the Flipped Classroom from the Students’ Point of View – 90 Minutes
Marien Cendon, Miami Dade College, mcendon@mdc.edu

*Sponsored by Pearson*
What is it like for a student to be in an interactive classroom? Please join Marien Cendon of Miami Dade College as she flips the traditional HAPS workshop. Come experience a flipped classroom where you will participate in a session that uses cloud-based constant formative assessment with critical thinking questions and sketching on A&P illustrations. We’ll explore a different kind of A&P interactive class with peer instruction based on your responses. Bring your smartphone, tablet, or computer to this hands-on workshop that uses cutting edge flipped classroom techniques and technology.

105 (Room BV 3.328) – Ovarian Follicle Selection: An Update on Hormones and Ovarian Function – 90 Minutes
Chad Wayne, University of Houston, cwayne@uh.edu

The process of dominant follicle selection which leads to the selection of a single ovum for ovulation is the result of a complex interaction between the endocrine and reproductive systems. If the primary function of the ovary is to produce a viable gamete, then it would follow that dominant follicle selection would be an important physiological process to understand. This update will go beyond the standard textbooks to explore how a single follicle is recruited from a cohort of follicles to become the dominant follicle. In addition, the hormones of the menstrual cycle and the regulatory mechanisms responsible will be examined.
106 (Room BV 3.330) – Physiology-MAPS: Assessing Student Learning Across an Entire Physiology Program – 90 Minutes
Katharine Semsar, University of Colorado, Boulder, katharine.semsar@colorado.edu
If you are looking for an instrument to measure student learning across an entire physiology program, the upcoming Physiology-MAPS might be just the instrument you are looking for. We welcome you to come review assessment questions currently in development, provide feedback from the point of view of your own program, volunteer for Physiology-MAPS piloting, and join in a discussion of how and when key physiological concepts are taught over the course of an entire curriculum.

107 (Room DB 2.222) – Improving Student Success towards a Health Science Career with Technology-Enriched Redesigned STEM Courses – 90 Minutes
Meg Flemming, Austin Community College, mfenmin@austincc.edu, Rick Fofi, Austin Community College, rfofi@austincc.edu
The STEM pre-requisite courses for health science programs have long been a barrier to student success. In response, the Biology Innovation Lab at Austin Community College used a Department of Labor grant to redesign BIOL 1308, Biology Fundamentals, BIOL 2101/2304 Human Anatomy and BIOL 2404, Introduction to Anatomy & Physiology. The modularized course material creates a “flipped” approach with extensive in-class active learning opportunities. We will present examples of the modules, the hands-on activities and the data showing improved student success. Your tax dollars at work! The modules will be free of charge to any school wanting to adopt them!

108 (Room DB 2.228) – Using the Life Sciences Teaching Resource Community (LifeSciTRC) to Support Vision and Change and Next Generation Science Standards Evidenced-based Teaching – 90 Minutes
Julie Dais, Okanagan College, jdais@okanagan.bc.ca, Miranda Byse, The American Physiology Society, mbyse@the-aps.org
*Sponsored by American Physiology Society and HAPS*
Vision and Change is a framework of core concepts and competencies for undergraduate life science education developed by AAAS and NSF. Learn how one teacher is introducing Vision and Change to her classes and labs through activities and collections found in the Life Science Teaching Resource Community (LifeSciTRC). Then, receive a hands-on walkthrough of how to find resources for your own courses in the LifeSciTRC. HAPS is a founding partner of the LifeSciTRC, which is a free online educator community and digital library of over 7,000 free peer-reviewed resources.

109 (Room DB 2.304) – Low-cost 3D Printing for A&P Labs: Make What You Need When You Need It – 90 Minutes
John Pattillo, Middle Georgia State College, john.pattillo@mga.edu
Models are essential tools for learning in A&P. However, we may not always have the models we need, or we may wish to create novel models to better suit our students or teaching styles. 3-D printing is a rapidly developing technology that may solve these problems. Using a low-cost printer and free software, it is possible to create a variety of models from publically available anatomical data. These data may also be combined in creative ways to make new and unique models. Come learn about the challenges of 3D printing, and how this exciting technology can enhance your A&P labs.

110 (Room DB 2.306) – Building Critical-Thinking Skills through Innovative Active Learning Strategies Centered Around a Teaching-Assistant-Based Learning Model – 90 Minutes
Cathy Whiting, University of North Georgia - Gainesville, Cathy.Whiting@ung.edu, Mark Green, University of North Georgia - Gainesville, magree7145@ung.edu, Dylan Shearer, University of North Georgia - Gainesville, djshea8786@ung.edu, Paul Siegrist, University of North Georgia - Gainesville, pmsieg1596@ung.edu, Shannon Sutton, University of North Georgia - Gainesville, assutt0742@ung.edu, Britany Bailey, University of North Georgia - Gainesville, bbail7902@ung.edu, Jancy Burge, University of North Georgia - Gainesville, joberge4207@ung.edu, Ryan Martucci, University of North Georgia - Gainesville, rtmart9457@ung.edu, Caitlin Trout, University of North Georgia - Gainesville, cltrou4888@ung.edu
Come join us for an interactive demonstration of active learning techniques that will transform your labs. Imagine students preparing for lab by completing their pre-lab assignments. Imagine them staying actively engaged and focused for the entire lab period instead of rushing through activities as quickly as possible so that they can leave early. We will present innovative strategies centered around a teaching assistant-based learning model to help you create a rigorous, dynamic learning environment in which your students can excel as they build critical-thinking and problem-solving skills.
111 (Room DB 3.316) – Using Electromyography to Demonstrate Skeletal Muscle Physiology – 90 Minutes
Aaron Fried, MVCC, afried@mvcc.edu, Don Kelly, MVCC, dkelly@mvcc.edu, Wes Colgan, ADInstruments Inc, w.colgan@adinstruments.com
*Sponsored by ADInstruments Inc*
This is a demonstration of a customized laboratory exercise used at MVCC that replaces the traditional frog gastrocnemius muscle laboratory activity. Using an ADInstruments data acquisition system, the activity of the triceps, biceps and flexor digitorum superficialis muscles will selectively be recorded during several maneuvers. In small groups, participants will actively predict and test hypotheses about muscle electrophysiology, concentric and eccentric actions of muscles, and analyze EMG data to answer questions about the agonist/antagonist relationship between the biceps and triceps as well as grip force fatigue in the forearm. Demonstration includes description of LabAuthor to customize lab activities.

112 (Room FS 1.512) – Less Blah, Blah; More Aha - Best HAPSter Demos – 90 Minutes
John Koch, John Tyler Community College, jkoch@jtcc.edu, Terry Thompson, Wor-Wic Community College, tthompson@worwic.edu, Carol Veil, Anne Arundel Community College, cbveil@aacc.edu, Javni Mody, Anne Arundel Community College, jmody@aacc.edu, Robin McFarland, Cabrillo College, romcfarl@cabrillo.edu, Karen McMahon, University of Tulsa, karen-mcmahon@utulsa.edu
Eight HAPSters are collaborating to show and explain their best, student-tested, in-class demonstrations that help students gain a particular insight or inspiration. A wide range of anatomical and physiological principles and processes will be included, focusing on those that often evade students through misconceptions or confusion. Each presenter will provide workshop attendees with a handout describing the materials needed and the instructions for how to construct their own demonstration materials. A brief question/answer/comment period will follow each demonstration. Attendees are sure to leave with at least one, and likely several, dynamite demonstrations to enlighten and energize their students.

113 (Room FS 2.520) – How We Teach: The Myths and Facts of Learning Styles, Critical Thinking, and Active Learning – 90 Minutes
Peggy Van Meter, Penn State University, pnv1@psu.edu, John R. Waters, Penn State University, johnwaters@psu.edu
Anatomy and physiology educators often speak of how we integrate critical thinking and active learning into our courses, and we are encouraged to design lessons and adopt products that address students’ learning styles. But what do these terms really mean? Are they marketing buzzwords or are they concepts supported by well designed studies? In this workshop, we will discuss how educational psychology research can help instructors separate myth from fact, and design meaningful curricula for our students.

Tuesday, Session 2

201 (Room BV 3.306) – Incorporating a Modified “Interteaching” Methodology into Anatomy & Physiology Lecture Settings – 60 Minutes
David Mercer, Salem State University, dmercer@salemstate.edu
Interteaching is a technique developed by behavioral analysts to promote deeper student learning by encouraging student teaching. Several studies demonstrate improved student test scores when compared to traditional lecture methods in diverse fields of study. This workshop will describe interteaching in its original format, its use in an Anatomy and Physiology course, the improvement in test scores compared to lecture-only classes, and the limitations when used in its original form. In addition, the workshop will introduce modifications made to the interteaching technique to make it more engaging and acceptable for students in learning the complex concepts of human physiology.

202 (Room BV 3.324) – I Want to Flip my Class! Now what? – 60 Minutes
Leslie Day, Northeastern University, l.day@neu.edu
Flipping a classroom is a great way to get students engaged in active learning. I have been flipping my 100+ class for the past 4 years and will share my ups and downs. This workshop will explore the tools you can use to help you flip a classroom, including prerecorded lectures (Camtasia, Tegrity, etc.), different classroom performance devices (clicker), online activities, and in-class interactive activities.
203 (Room BV 3.326) – Flipping Histology: An Interactive Lymphatic Adventure – 60 Minutes
Barbie Klein, Indiana University Bloomington, barbklei@indiana.edu
The flipped classroom is a style of instruction where students review material prior to class and traditional lecture time is devoted to application and collaboration. Last year I developed a flipped class for the lymphatic system in a medical-level histology course. Students prepared by reviewing assigned material then lecture began with a short pre-test followed by groups working on three computer-based clinical cases. In this workshop we will go through how to construct an interactive hyperlinked document from learning objectives, reflect on student perceptions, and discuss ideas for future flipped classes.

204 (Room BV 3.328) – Unburdening Content-Heavy A&P Courses – 60 Minutes
Kartika Tjandra, Mount Royal University, ktjandra@mtroyal.ca
Content-heavy first year A&P courses are often associated with a high DFW rate. There is no single attributing factor leading to a high DFW rate in these foundational A&P courses, however, a combination of factors may contribute to students’ poor performance. To gain a deeper understanding of these issues, we underwent a one-year period of intensive “course-redesign” for our A&P courses, in collaboration with our nursing colleagues. Many aspects of the course and its delivery were well dissected. Come and find out what we learned from this process and the positive impact it may provide to our students.

205 (Room BV 3.330) – Rational Course Design – 60 Minutes
Wendy Riggs, College of the Redwoods, wendy-riggs@redwoods.edu, Margaret Weck, St. Louis College of Pharmacy, Margaret.Weck@stlcop.edu
In this session an outline for a system of backwards course design will be presented. Members of the Fall 2014 HAPS-I course: Rational Course Design will present their impressions of the value and frustrations of their first attempts to apply the principles of backwards course design to their personal teaching contexts.

206 (Room DB 2.228) – MasteringA&P and MyReadinessTest: A First-Timer’s Guide – 60 Minutes
Shawn Macauley, Muskegon Community College, Shawn.Macauley@muskegoncc.edu
*Sponsored by Pearson*
This session will introduce participants to MasteringA&P, an advanced online science tutorial and homework system that allows instructors to give students personalized attention outside of office hours, and MyReadinessTest, a powerful online system designed to assess pre-A&P students’ proficiency in the foundational concepts needed for success in human anatomy and physiology courses and efficiently remediate gaps in targeted topics. Come see how Dr. Shawn Macauley uses MyReadinessTest and MasteringA&P in his course, which will include an overview of creating homework assignments, reviewing student work, and exploring available teaching diagnostics to increase student success.

207 (Room DB 2.304) – An Integrative Approach to Course Assessment and Feedback – 60 Minutes
Nahel Awadallah, Johnston Community College, nwwawadallah@johnstoncc.edu
Many of us teaching A&P seek to assess student understanding for every chapter. Course Assessments involves everyone, from top-level administrators to teaching faculty and students. Faculty must demonstrate that specific learning objectives are being met by students under the guidance of their departments. Is that enough? What are we missing? This presentation will discuss technology used to streamline and simplify assessment. It will include a new integrative approach to assess student mastery of anatomy and physiology. The integrative assessment approach will shape and revise your teaching methodology to make it work best for your students. It is a challenging and exciting approach.

208 (Room DB 2.306) – Connecting Students to Cellular Respiration – 60 Minutes
Patricia Visser, Jackson College, patricia_visser@jccmi.edu
Having problems with students making the connections between cell activity, ATP production, carbon dioxide (and other waste) production and cardiovascular modifications? Learn about a simple lab activity that measures carbon dioxide production during various levels of activity -- where you get to be the student this time. Calculations and post-activity “thought” questions will also be presented.
209 (Room DB 3.316) – Setting the New Standard for Immersive, Interactive Learning with Lt – 60 Minutes
Wes Colgan, ADInstruments Inc, w.colgan@adinstruments.com, Arianna Boulet, ADInstruments Inc, a.boulet@adinstruments.com, Chris Wright, ADInstruments Inc, c.wright@adinstruments.com
*Sponsored by ADInstruments Inc*
This workshop is a repeat of session 609
After 27 years at the cutting edge of life science education, ADInstruments is bringing a new element to the table. Lt is the only cloud-based teaching system that allows you to record and analyze physiological signals with your teaching curriculum to engage and inspire your students. Lt is optimized for any browser or mobile device for continued learning most anywhere. Lt was designed to have comprehensive course management capabilities combined with more intuitive authoring tools that make teaching easier, and learning more engaging. Come and see some of your favourite anatomy and physiology topics elevated to a completely new level.

210 (Room FS 1.512) – An Active Learning Approach Utilizing Case Study Presentations to Demonstrate Physiological Principles in A & P – 60 Minutes
Bernadette Dunphy, Monmouth University, bdunphy@monmouth.edu
Student engagement, interactive learning and flipping the classroom are all possible techniques to better deliver material to students for increased learning. A student presentation of case studies with analysis on physiological processes is an alternative to these other non-lecture approaches. This workshop will review the methods by which case study presentation can be used to compare normal physiological principles to abnormal physiology leading to a disease process.

211 (Room FS 2.520) – Collaborative Learning/Testing of Human Muscles – 60 Minutes
Joyce Jennings-Pineda, Missouri State University West Plains, joycepineda@missouristate.edu
In the past, the one lab exam given in our Human Anatomy course at Missouri State University West Plains which proved for many years to “make or break” many nursing and allied health students’ ability to succeed has been human muscle nomenclature. To improve student learning of human muscles in the Human Anatomy course at Missouri State University West Plains, a collaborative approach was used in both learning and testing of human muscle nomenclature. Comparison of three fall semesters using the new approach showed there was an average increase of 36% of students meeting the course objective related to recognizing nomenclature of human muscles.

Tuesday, Session 3

301 (Room BV 3.306) – Bloom’s Taxonomy - A Way to Determine Cognitive Level of Course Materials When used Correctly – 60 Minutes
Janet Casagrand, University of Colorado, Boulder, Janet.Casagrand@colorado.edu
Bloom’s taxonomy is a widely accepted tool for delineating understanding into six cognitive levels: knowledge/remember, comprehension/understand, application/apply, analysis/analyze, synthesis/create, and evaluation/evaluate. Bloom’s taxonomy offers a means for developing assessments at appropriate levels; categorizing levels targeted by learning objectives or assessments; and assessing curricular alignment. Although Bloom’s taxonomy can be a useful tool, there can be confusion/misconceptions when ‘Blooming’ course materials. For example, a question may be higher level initially, but if given again becomes merely remember level. After discussing the categories, participants will work with a dichotomous key and sample questions.

302 (Room BV 3.318) – Conscience in Crisis: the Nazi Academics – 60 Minutes
Aaron Fried, MVCC, afried@mvcc.edu
Anatomists benefited from the Nazis. Universities accepted bodies from political prisons. Prisoners executed for espionage were being used for teaching and research. Academics were flourishing with a large supply of cadaver materials for research and teaching. After World War II, most who worked the Nazi camps were tried as war criminals while the academics kept working without rebuke, often using the source materials gained unethically. This workshop will examine the history of academic anatomists under the Nazis. How should these specimens have been dealt with? What do you do with the knowledge gained from experiments and work with these tissues?
Students enrolled in human anatomy courses frequently complain about the amount of memorization required. Experienced educators know that a deeper, conceptual understanding of human anatomy requires more than just memorization. This workshop marks the beginning of a long-term project to identify the core-concepts of human anatomy and target successful teaching and learning methods to move students beyond the idea of rote-memorization. The products from this workshop will be used to develop inquiry-based curriculum materials for entry-level human anatomy students. Anatomy educators with several years of teaching experience are especially needed for this project—we need your wisdom!

Medical school ranks as one of the most popular career goals among incoming first-year students in the Life Sciences. As such, this presentation will focus on how faculty and advisers can help their students prepare and succeed when applying to medical school. The information provided will help faculty and advisers to become familiar with current medical school statistics, the characteristics of a competitive applicant, the 2015 MCAT, changes to the applicant pool, and to distinguish between medical school myths and facts. Furthermore, we will look at traditional and non-traditional ways of applying as well as alternative medical careers, and the important role that faculty and advisers play in this process. The presentation will be followed by a question and answer session.

Role-playing simulations can help students master complex processes. By acting out physiological events, students can clarify their understanding of cause-and-effect relationships and more easily remember multistep pathways. Students watching the simulation can be engaged by dividing the class into support groups for the actors, and asking groups to predict how the simulation will change under various conditions. In this workshop I will introduce simulations designed to teach 1. feedback in the hypothalamo-pituitary-target gland axis using music; and 2. ventilation mechanics. I’ll also present data evaluating the effectiveness of the simulations and discuss methods to maximize student engagement and account for student diversity.

Students struggle understanding blood cell anatomy and changes that occur during disease states. A classroom-tested, blood cell model is shown to enable students to instantly grasp normal blood cell anatomy, and many types of leukemia. Using lesson plans and disposable kits, students create their own blood cell models to understand what goes wrong leading to disease states. Students also learn quantitative analysis of blood cells and use kits to key down specific diseases. The blood cell kits presented here can be used at all levels from high school to medical school providing students an instant grasp of blood cell disorders.

The key to learning is passion. Understanding—the human body involves internalizing your experiences while learning about the senses. One of my passions is brewing beer and I can show you how to use that passion to enliven your students’ appreciation of their senses. Come experience the ingredients in a way you never thought of before.

The brain functions as an important regulatory organ. The various lobes and regions of the brain are responsible for interpreting sensations, creating memories, and controlling or influencing body function. Participants will use modeling clay and Maniken™ models to build the anatomy of the brain.
309 (Room DB 3.316) – Using Student Focus Groups to Improve Subject Design and Faculty Performance – 60 Minutes
Robert Paine, LaTrobe University, r.paine@latrobe.edu.au
We use student focus groups to evaluate our subjects and teaching.
The purpose of this workshop is to share ideas and search for best methods in setting up and conducting the focus groups.

310 (Room FS 1.512) – In-Class Activities and Strategies for the Flipped Classroom – 60 Minutes
Jeanine Page, Lock Haven University, jpage2@lhup.edu
One of the most challenging aspects of teaching anatomy and physiology in the flipped classroom setting is creating new and engaging in-class learning activities. I have developed activities that will keep students focused and engaged, and allow the students to see the material from a new and more approachable perspective. These activities can be easily adapted to a variety of classrooms. This workshop will focus on giving instructors new ways to present, and even demonstrate, difficult concepts including: glomerular filtration, lung volume and pressure relationships, muscle contraction and ABO blood typing.

311 (Room FS 2.520) – Increasing Student Motivation Using Assignments and Grading Schemes that Foster “Hope and Grit” – 60 Minutes
Kevin T. Strang, University of Wisconsin, kstrang@wisc.edu
*Sponsored by McGraw Hill Higher Education*
One determinant of student success is the degree of motivation. Some students may perform poorly, not because of a lack of intelligence, but because the structure of assignments and grading schemes either fail to motivate or implicitly discourage them. Class performance data from two successive years of the same large physiology class will be presented: a control year, and then a year in which a “Hope and Grit” grading scheme was adopted and homework assignments were presented in measured doses. Did these changes have a significant impact on the motivation of students in the lower quintiles? Come and find out!

Tuesday, Session 4

401 (Room BV 3.306) – Beyond the Hype: Three Types of “Must-Have” Data – 60 Minutes
Holly Houtz, Hands-On Learning, holly.houtz@holscience.com
*Sponsored by Hands-On Learning*
New technologies are all the rage. Today’s tools claim to drive retention and student engagement. But are we getting the data we need? How can data truly ignite actions that improve educational effectiveness? This workshop will help educators work smarter, not harder by teaching them how to get the three types of data they need to track student knowledge gain, apply actionable analytics in the A&P classroom, and predict trends in a larger population of students. We’ll cover all the basics, from generating quantifiable learning objectives to analyzing student performance. Come ready to proof out your best teaching practices!

402 (Room BV 3.318) – Integrating Anatomy & Physiology Revealed into your Classes – 60 Minutes
Greg Reeder, Broward College, greeder@broward.edu
*Sponsored by McGraw Hill Higher Education*
Most of us are limited in our teaching of ‘human’ anatomy to the use of plastic models or preserved animals for dissection. In this workshop, you will be able to see how A&P Revealed 3.0, the customizable human cadaver dissection program, can enhance any class. Come and learn how easy it is to use, how it integrates with Connect, and how to access many amazing free resources. This workshop will let exciting new information “out of the bag” regarding the Anatomy & Physiology Revealed Cat and Fetal Pig versions now available.

403 (Room BV 3.324) – Now You’re the Doctor – A Diagnostic Game – 60 Minutes
Tirzah Birk, Ivy Tech, tbirk1@ivytech.edu
This active-learning game provides a technology-free alternative to engage the entire class. Given a set amount of money, the student “doctors” purchase diagnostic tests and treatments while cost increases with each decision. In this session participants will experience the game, learn student responses from a case-study, and understand how to recreate this experience.
How to Make a Large Classroom Feel Small – 60 Minutes
Jon Runyeon, University of Oregon, jrunyeon@uoregon.edu, Jacqlyn King, University of Oregon, jhyler@uoregon.edu
Large class sizes are a reality for many who teach in higher education. The physical design of large classrooms imposes a teacher-centered approach, where the instructor is viewed as the content expert and students assume the role of passive and invisible participants. During this workshop, we will share techniques to help you transform your large (or small) classroom into an engaging experience where students have the opportunity to apply knowledge from their preparatory assignments and interact with their team of instructors. You will leave this workshop with a new outlook on what can be achieved in a large-class room setting.

Estrogen and Estrogen Receptors in the Aging Female Heart: What Happened to Hormone Replacement Therapy? – 60 Minutes
Nanette J. Tomicek, The Pennsylvania State University, njt128@psu.edu
Heart disease remains then number one killer of women, and disease prevalence increases 2- to 3-fold following menopause. Clinical trials, such as the famous Women’s Health Initiative (WHI) of the 1990s, have failed to demonstrate cardioprotective benefit from chronic estrogen replacement therapy. Where are we now with estrogen therapies? Topics to be discussed include a review of past estrogen therapies, original research on estrogen receptors, and a current update on therapies for prevention and treatment of aging women with heart disease.

Whole Body Anatomy & Physiology Final Projects: Using Student Presentations to Prepare for the Comprehensive Exam – 60 Minutes
Brenda del Moral, Edgewood College, bdelmoral@edgewood.edu
Students often struggle to find meaningful ways of preparing for their anatomy and physiology comprehensive exam. The presenter will introduce a method that has students prepare each other for the exam in the final day of class. A group of students are assigned a body system and asked to create a 10-minute presentation on normal homeostatic function and disruption in type 2 diabetes mellitus. Details of the presentation and assessments will be provided, and then we will break up into groups to create our own presentations. Participants will be encouraged to share their feedback on the process.

Teaching with Analogies to Make Meaningful Associations for Students – 60 Minutes
Bobbi Patton, York College of Pennsylvania, bpatton2@ycp.edu
Closet cleaning? Toilet flushing? Conveyor belts? How can these topics be used to teach physiology? Strategic, effective analogies enable students to learn new concepts by making associations with their existing knowledge. Have you considered the strengths or weaknesses of the analogies you use or whether they are tailored to your student population? This workshop will describe the teaching-with-analogies model and evaluate some analogies specific to anatomy and physiology. Most importantly, you will generate some of your own analogies working in small groups so you can leave with new meaningful associations for your students to apply to difficult concepts.

The Musculated Skeleton – 60 Minutes
Thomas H. Lanthorn, LoneStar College System, Montgomery, Thomas.Lanthorn@lonestar.edu
Teaching how muscles make bones move can be challenging because of the disconnect between the full-size, articulated skeletons and the solid, immovable muscle models that cannot be connected with the skeleton. The musculated skeleton combines both using springs/bungee cords that can be attached to the origins and insertions of 26 muscles -- the primary ones used to teach muscles and their origins and insertions. Students learn, by doing and directly observing, 1) how muscles move bones, 2) how muscles stabilize joints, and 3) why specific origins and insertions are critical for specific movements.

Decoding Genetics: Fun Hands-On Material to Teach Introductory Concepts of Genetics – 60 Minutes
Shani Golovay, Simpson University, sgolovay@simpsonu.edu
Teaching the genetics section of an anatomy and physiology course can be costly and often inefficient. There are many great free resources such as paper PCR and extraction of DNA from a strawberry using household products that can curb the cost of more expensive genetics labs. We will discuss strategies for dealing with Punnett squares, transcription & translation, gel electrophoresis, PCR, and genomic libraries. What is fundamental genetics information? We will discuss strategies to make this section more memorable and engaging.
410 (Room FS 1.512) – It’s Time to Start Using the HAPS Comprehensive A&P Exam - We Will Show You How and Why – 60 Minutes
Jennifer Burgoon, The Ohio State University, jennifer.burgoon@osumc.edu, Members of the Testing Committee
*Sponsored by HAPS*

The HAPS Comprehensive Exam has seen amazing growth in the past few years, and has had tremendous work accomplished in validating the test both with content experts and psychometricians. The exam is among the most inexpensive on the market, yet offers top tier security and reporting. The test follows the HAPS learning outcomes and is used to characterize entire programs, individual instructors, and has been used as a final exam for individual students. We will answer all of your questions and show you how easy it is to implement this assessment tool into your curriculum.

411 (Room FS 2.520) – Mysteries at the Microscope: Histopathology Case Studies as a Tool for Teaching Undergraduate Histology – 60 Minutes
Nina Zanetti, Siena College, zanetti@siena.edu

Histology is often perceived by undergraduates as difficult, dull, and irrelevant. This workshop explores how instructors can use case studies, with photomicrographic images of actual pathology specimens, to improve student engagement in learning histology. Participants will work in groups to “solve the mystery” of several histopathology-oriented case studies taken from the “Histology Challenge,” a regular feature on the HAPS website. Each case will involve reviewing basic histology, interpreting photomicrographs, and ultimately diagnosing the disease. We’ll also share resources for case study materials and ideas for using them to reinforce students’ mastery of basic histology in A & P courses.

412 (Room FS 3.512) – Increasing Student Engagement – and Educator Satisfaction – with Biopac Student Lab 4.1 – 60 Minutes
Ken Graap, BIOPAC Systems, keng@biopac.com, William McMullen, BIOPAC Systems, William@biopac.com
*Sponsored by BIOPAC Systems*

Life science educators aspire to deliver great teaching that allows the students to obtain a high degree of knowledge while building a confident commitment to learning. Based on extensive input from educators across the globe, the new Biopac Student Lab 4.1 features a variety of new functionality that helps educators deliver more inspired teaching including brand new lessons, Dropbox integration for lesson access anywhere and new hardware support. This workshop will detail these new features and the new Curriculum Management System (CMS) licensed feature that allows instructors to control and customize all aspects of the lesson content using a simple visual text editor.

Wednesday, Session 5

501 (Room BV 3.306) – What Type of Learner are You? Learning Styles of Undergraduate Gross Anatomy Students. – 60 Minutes
Melissa M. Quinn, The Ohio State University, quinn.269@osu.edu, Jennifer Burgoon, The Ohio State University, jennifer.burgoon@osumc.edu

In order to categorize ways that people learn, learning styles instruments have been created and administered. These tools are useful as they allow instructors to learn more about students, as well as aid in the development and application of useful teaching approaches. Because anatomy is at the core of health professions, there has been much research in understanding its instruction in professional programs (i.e., medical and dental) and how learning style preference can influence students’ achievement. At the undergraduate level, research has focused on learning style preferences of physiology students, with a noticeable lack in the gross anatomy field.

502 (Room BV 3.318) – Using Embedded Common Finals to Promote Learning and an Assessment Culture – 60 Minutes
Abass Abdullahi, Bronx Community College of CUNY, abass.abdullahi@bcc.cuny.edu, Maureen Gannon, Bronx Community College of CUNY, maureen.gannon@bcc.cuny.edu

Embedding questions in comprehensive finals is an efficient way to provide content analysis to assess if students are meeting the course learning outcomes. Common questions are part of our final cumulative exams in all anatomy and physiology sections, thus reporting the results are as automatic as reporting final grades. This presentation will discuss efforts by course coordinators to promote a faculty driven practical assessment culture that reveals student learning, while maintaining academic freedom. This process has been streamlined and has led to a systemic and sustainable assessment practice, which has allowed for easier implementation of course and curricular improvements.
Critical thinking is an essential student learning outcome for science courses. Help your students think outside of the box (lab manual) by teaching them to design their own experiments. By guiding your students through the scientific method of hypothesis formation, experimental design, data collection and analysis, research paper preparation and poster presentation preparation, your students will improve their critical thinking skills and gain deeper knowledge in their particular research area. Additionally, students practice their “soft skills” such as creativity, problem solving, organization, time management, and communication. The presenters have used this assignment for more than five years. Sample research projects from freshman-senior level courses will be presented.

Avoiding CATastrophe: Distance Labs that Rock – 60 Minutes
Holly Houtz, Hands-On Learning, holly.houtz@holscience.com
*Sponsored by Hands-On Learning*
Science in the distance classroom is often belittled, frowned upon, and outright argued against. “How could we ever create an online lab course better than the traditional classroom?!” Join this workshop for a lively discussion about ways that distance labs trump traditional labs. Leave prepared to convince your skeptical colleagues. The conversation will be modeled around cat dissections, and we’ll cover: (1) Learning Anytime, Anywhere, (2) The Un-Diluted Experience, (3) Lengthy Activities, (4) Having it All in One Place.

The Importance and Benefits of Low-stakes Online Practice Exams for Student Success in A&P classes – 60 Minutes
Peter Reuter, Florida Gulf Coast University, preuter@fgcu.edu
The session presents the results of a study that examined the effects of completing online practice exams by students enrolled in Human Anatomy & Physiology I and II on individual formal exams and overall course success. Results showed that students who took all four practice exams had a higher passing rate than the class as a whole, including students that did not take any practice exams. The study also showed that the percentage of students getting an A as a final grade was more or less constant regardless of whether students took all, some or none of the practice exams.

Engaging the Community in Science: An Often Overlooked Scientific Skill – 60 Minutes
Louise Lexis, La Trobe University, l.lexis@latrobe.edu.au
Effectively communicating science to multiple audiences is a critical skill for scientists, medical and dental professions, and allied health disciplines. Our students were tasked with creating a piece of work (their choice of medium) to communicate an aspect of human physiology to a chosen target audience. Students created a range of pieces including video clips, claymations, animations, board games, brochures, and story books. Target audiences included primary school students, high school students, the general public, and populations with a variety of illnesses. We describe the scaffold used to support students through this skill-building exercise, and provide examples of students’ work.

Understanding the Mediastinum and Thoracic Surface Anatomy – 60 Minutes
Mark Nielsen, University of Utah, marknielsen@bioscience.utah.edu
For the medical professional there is really only one region of importance in the thorax - the mediastinum. A strong knowledge of mediastinal anatomy and its structural relationships is paramount to surgical procedures of the thorax, reading MRI and CAT scan films, and understanding the spread of disease and inflammation. This presentation will use embryological principles to illustrate simple patterns in the structural organization and relations of the mediastinal anatomy and clearly show how this anatomy can be visually mapped to the surface of the body.

“Express it and guess it”: A Word Game to Review Anatomy and Physiology Terms – 60 Minutes
Kathy Burleson, Hamline University, kburleson01@hamline.edu
Learning the terminology is an important part of mastering anatomy and physiology content—why not make it fun? In this workshop, a customizable version of a popular board game will be introduced which can be modified for a variety of classes to give students an interactive review of course vocabulary. An overview of the game and student feedback will be presented, and participants will get a chance to play the game themselves.
509 (Room FS 1.512) – Do Something! A Toolkit of Strategies to Promote Active Learning – 60 Minutes
Wendy Riggs, College of the Redwoods, wendy-riggs@redwoods.edu
Active learning increases student engagement and success. This workshop will facilitate the sharing of different classroom strategies to promote active learning in a lecture-based or flipped class.

510 (Room FS 2.520) – Pre-lecture Reviews with Anatomy Tunes – 60 Minutes
Anthony Weinhaus, University of Minnesota, weinh001@umn.edu, Jason Massey, University of Minnesota, masse051@umn.edu
Designed to engage students, review material, and introduce new topics, we developed a new learning tool which is conducted before lecture to incentivize student attendance and encourage early arrival. This tool consists of playing a programmed, continuously looping, quick-paced slide presentation which reviews the material from the previous lecture. Popular music is played with themes consistent to introduce the subsequent lecture. Students find the exercise a productive use of time. We will share tips from the classroom on creating, timing, and running the presentation. Will also share our lists of anatomy-related music (also bring your own ideas to share).

511 (Room FS 3.512) – Teaching Online Anatomy/Physiology: Digital Techniques that Appeal to the Senses and Emotions – 60 Minutes
R.S. Pozos, San Diego State University, bpozos@gmail.com
*Sponsored by Anatomy in Flashcard Learning System*
Online courses of Anatomy/Physiology require a presentation style that appears to the auditory and visual sense to be effective. The workshop will demonstrate various new digital techniques used to engage students. The unifying concept of this workshop is the use of dynamic moving cursors that highlight images or graphs and their associated music/sounds which enhance the mastery of concepts in Anatomy/Physiology. In addition, these techniques engender emotion(s) which may assist the student in mastering concepts or remembering facts. Examples of these digital techniques will be available for free download.

**Wednesday, Session 6**

601 (Room BV 3.306) – Role Play, Model Creation, and a Few More Ways to Enhance Understanding – 60 Minutes
Patricia Hernandez, Abilene Christian University, hernandezp@acu.edu
Role-playing and creating models are approaches that help students conceptualize and understand challenging biological processes. In role-play students “act out” interstitial fluid formation, peripheral resistance and plaque formation in a blood vessel, and neurotransmitter release. Using model magic, protein synthesis is simulated, ion channels are visualized, muscle fiber structure is created, and a 3D model of the nervous system structure is created. To understand the generation of an action potential, two colors of sticky notes are used to represent ions and are accompanied by a summary illustration. These activities incorporate all learning styles to learn complicated concepts in their own way.

602 (Room BV 3.318) – Graphic Representation in Undergraduate Anatomy and Physiology: Less is More? – 60 Minutes
Vasiliy Kolchenko, New York City College of Technology, vkolchenko@citytech.cuny.edu
Good graphics can be extremely helpful for anatomy and physiology students. On the other hand, some images can be confusing or overwhelming. How much is too much? Too little? We will discuss different types of graphic representation, from realistic to more abstract, trying to identify the optimal levels of abstraction for different media (print, video, slide presentation). We will also show how symbolic graphics can guide student learning in a more efficient way and will provide examples of successful implementation of the approach. This work is supported by the NSF TUES grant (Transforming Undergraduate Education in STEM).

603 (Room BV 3.324) – Comparative Study of Online, Hybrid, and Traditional Anatomy and Physiology Courses – 60 Minutes
Nahel Awadallah, Johnston Community College, nawadallah@johnstoncc.edu
Many colleges are offering traditional anatomy and physiology courses and few hybrid course sessions. There is an increase interest for online A&P course offering at different colleges. The study will compare success rates of students who took these courses; In addition, I will share the joy and challenges for each course format. The preliminary data might surprise you.
604 (Room BV 3.326) – Re-packing for our Teaching Journey – 60 Minutes
Terry Thompson, Wor-Wic Community College, tthompson@worwic.edu
*Sponsored by the HAPS-Thieme Award for Excellence in Teaching*
We all discover, borrow, adapt and even create new methods for our teaching tool-kits, but we can easily overwhelm ourselves and our students. We strive to improve assessments that measure students’ learning, but are we always aware of what is “under” that apparent understanding? I’ll share lessons learned from colleagues and students, experiences that have been most valuable in re-packing my own tool-kit and ways I’ve learned to prompt my students, exposing understanding gaps so I can anticipate and incorporate simple ideas into content overloaded A&P. Participants will be encouraged to share and take-away specific activities for their own re-packing.

605 (Room BV 3.328) – Moving Students from “What?” to “Why?” – 60 Minutes
Dean Furbish, Wake Technical Community College, dfurbish@waketech.edu
One measure of true learning is demonstrated by students who have moved from memorization to understanding. When students can explain why something is the case rather than merely reciting facts, they have successfully moved from “what” to “why.” Two unrelated theories (Myers-Briggs and philosophy of science) explain why the majority of students struggle with this transition. In this session, participants will receive tangible strategies that enable students to move from “what?” to “why?”

606 (Room BV 3.330) – Pre-semester Bridge Programs: How can they be used to Improve Student Retention in A&P? – 60 Minutes
Theresa Young, Middlesex County College, tyoung@middlesexcc.edu, Kimberly Fouad, Middlesex County College, kfouad@middlesexcc.edu
Looking for an intervention to improve student retention in your A&P course? Pre-semester bridge programs have been used for decades to help prepare at-risk students to be successful in their college careers. In this session we will engage in open discussion about ways that A&P instructors can adapt this common intervention to specifically target entering A&P students. Join us to share your ideas about what A&P students need to be successful and to discuss the use of pre-semester bridge programs as effective interventions. We will also share our plans for an A&P summer bridge program.

607 (Room DB 2.304) – Increase Student Success Using MasteringA&P’s Adaptive Learning Tools – 60 Minutes
Terry Austin, Temple College, taaustin@templejc.edu
*Sponsored by Pearson*
Combining diagnostics from pre-lecture assignments, additional post-lecture practice opportunities, and exam prep quizzes, MasteringA&P helps students with self-assessment and increases their success on exams. But what else can be done for students that accumulate gaps in their understanding of key A&P content as the semester progresses? Take your use of MasteringA&P to the next level by incorporating Dynamic Study Modules and Adaptive Follow-Up Assignments. See how these tools harness the latest educational research in neurobiology, cognitive psychology, game studies, and adaptive learning technology to help your students maximize their potential in your classroom.

608 (Room DB 2.306) – The Nerve of it All: The Brachial Plexus in 3-D – 60 Minutes
Christine Yu, Indiana University Bloomington, cidxi@indiana.edu
This workshop will present and encourage you to make the Brachial Plexus with pipe cleaners. The purpose of this activity is twofold: it provides you with a kinesthetic tool to aid student learning of the Brachial Plexus, and it will provide you with a super cool Brachial Plexus model that you can bring to parties and show to your friends (though it is not to scale). Materials and assembly instructions will be provided. Highlights from “A novel technique for teaching the brachial plexus” (2011) will be presented. Discussing “replication and extend” studies is an aim of this workshop as well.

609 (Room DB 3.316) – Setting the New Standard for Immersive, Interactive Learning with Lt – 60 Minutes
Wes Colgan, ADInstruments Inc, w.colgan@adinstruments.com, Arianna Boulet, ADInstruments Inc, a.boulet@adinstruments.com, Chris Wright, ADInstruments Inc, c.wright@adinstruments.com
*Sponsored by ADInstruments Inc*
This workshop is a repeat of session 209
After 27 years at the cutting edge of life science education, ADInstruments is bringing a new element to the table. Lt is the only cloud-based teaching system that allows you to record and analyze physiological signals with your teaching curriculum to engage and inspire your students. Lt is optimized for any browser or mobile device for continued learning most anywhere. Lt was designed to have comprehensive course management capabilities combined with more intuitive authoring tools that make teaching easier, and learning more engaging. Come and see some of your favourite anatomy and physiology topics elevated to a completely new level.
Student performance in histology, the microscopic study of tissues, can be significantly enhanced by several laboratory pedagogical tools. In a recent workshop, we proved that projecting real-time slide images (using a light microscope fortified with built-in camera) significantly improved students’ understanding and learning outcomes. In this workshop, I demonstrate how we used this microscopy to develop our own histology atlas. This important study resource, which features several slide views and magnifications, now allows students to take home an exact copy of specimens seen in the lab for independent review and reinforcement.

611 (Room FS 3.512) – Fostering Collaboration: Two (or more) Heads are Better than One – 60 Minutes
Daniel Kifle, Community College of Baltimore County, dkifle@ccbc.edu, Ellen Lathrop-Davis, Community College of Baltimore County, elathrop@ccbc.edu, Ewa Gorski, Community College of Baltimore County, egorski@ccbc.edu
Join us as we explore the benefits and challenges of projects involving student collaboration in face-to-face and online courses. Among the challenges to be addressed will be overcoming student reluctance, assessing student participation and involvement, assigning groups, and fostering true collaboration rather than splitting of workload.

Wednesday, Session 7

701 (Room BV 3.306) – A Non-Major Problem: How to Keep Non-Majors Interested in Your Biology Electives and General Education Courses – 60 Minutes
M. Esa Seegulam, Culver-Stockton College, mseeugolum@culver.edu
What place do basketball and soccer have in teaching anatomy? While we want ALL our majors to have the critical thinking and problem solving prowess that every successful graduate needs, a key roadblock has been getting them to enjoy it. If you care about this, you’ve come to the right place. We will discuss how slight curricular adjustments and interdepartmental cooperation can yield successful course outcomes by bringing something enjoyable – sports – into the mix of learning activities. I will share my practices in teaching the course “How the Body Works,” that yielded very positive outcomes in the liberal arts setting.

702 (Room BV 3.318) – Ending the Depth versus Breadth Debate: How to Utilize Innovative Techniques to Develop Curricula Based on the Recommendations from Vision and Change – 60 Minutes
Jason LaPres, Lone Star College-University Park, jason.h.lapres@lonestar.edu
*Sponsored by McGraw Hill Higher Education*
Vision and Change established that the way science has been traditionally taught no longer works and innovative methods of teaching and assessing are the future of biology education. In this workshop, participants will be introduced to innovative ways to leverage the McGraw-Hill suite of educational tools to enhance their courses and move in the direction of teaching concepts in a student-center classroom rather than just presenting a list of facts in a boring lecture. Additionally, the presenter will share features from newest edition of Gunstream’s Anatomy and Physiology that facilitate a student-center environment.

703 (Room BV 3.324) – Zombie A&P – 60 Minutes
Christopher Marks, University of Mount Union, markscp@mountunion.edu
Have you ever wondered how the undead body would function? This workshop provides insight into a fun activity aimed at reviewing two semesters of content. Students are assigned a specific organ system and challenged with the task of imaging how it would function in a zombie. Zombie geeks welcome. Not for the squeamish!

704 (Room BV 3.326) – Integrating Virtual Dissectors into a Hybrid, Graduate Anatomy Course which also Utilizes Cadaveric Study – 60 Minutes
Thomas P. Arnold, Nova Southeastern University, tarnold1@nova.edu
Physical and Occupational Therapy (DPT and OTD) students learn using a hybrid format in which students learn for 3 weeks online followed by 4 days with face-to-face instruction. Lectures are delivered via asynchronous and synchronous platforms. The challenge in an anatomy curriculum delivered in a hybrid format is selecting instructional strategies for both virtual and classroom experiences. Virtual strategies include recorded lectures, videos and dissectors, whereas face-to-face strategies are active, hands-on, and collaborative learning. Access to the virtual dissectors are at the on-line library portal via any device (computer, lap-top or tablet) with internet access.
705 (Room BV 3.328) – Student Engagement; Join the Conversation! – 60 Minutes
Mari Hopper, IU School of Medicine, mkhopper@iupui.edu
College administrators use data from the National Survey of Student Engagement (NSSE) to drive curricular revision. Faculty are strongly encouraged to improve student engagement (SE), yet NSSE data is not applicable to individual courses. An Advanced Human Physiology course was designed employing methods to maximize SE. An engagement survey was administered in multiple biology courses and SE was significantly higher (p<0.001) in the advanced physiology course. Come join a conversation to: 1) discuss how NSSE data should be utilized; 2) what means are available to directly assess SE in your classroom; and 3) share strategies and methodologies to maximize SE.

706 (Room BV 3.330) – Role Playing through Medical Terminology – 60 Minutes
Brenda del Moral, Edgewood College, bdelmoral@edgewood.edu
Many students take a medical terminology class in addition to a year-long sequence in anatomy and physiology at Edgewood College. In this hands-on workshop, the presenter will introduce the framework for a dynamic, group-based way of teaching medical terminology online, and then we will form groups to try it out ourselves. Find out why students enjoy learning medical terminology by rotating through the roles of attending physician, intern, nurse, and medical technologist using published case reports. A discussion will ensue that addresses how this active learning method can facilitate the learning and the review of anatomy and physiology.

707 (Room DB 2.304) – Diagnosing How Students Organize Their Knowledge – 60 Minutes
Eileen Bush, Mohawk Valley Community College, ebush@mvcc.edu
Many instructors wonder if students are making accurate, meaningful connections between various concepts during their study of anatomy and physiology. The use of concept maps is just one way instructors can uncover the accuracy and depth of connections being made between concepts during the learning process. If you are unfamiliar with the use of concept maps and would like to explore their use with students, this workshop is for you.

708 (Room DB 2.306) – “Kneesy Does It” – 60 Minutes
Steve Kish, Zane State College, skish@zanestate.edu
*Sponsored by Anatomy in Clay® Learning System*
Regional anatomy allows a person to study the relationship between various structures located within that region. Participants will build the anatomy of the knee joint using Maniken™ models. The focus will be on the relationships between the skeletal, muscular, nervous, and vascular components, how they are supposed to function under normal conditions, and explore disorders that can affect the knee joint.

709 (Room FS 1.512) – Teaching a Study Skills Course to Anatomy Undergraduates: Activities and Lessons Learned – 60 Minutes
Bradley Barger, Indiana University, jbbarger@indiana.edu
Have you found your anatomy students lack the study skills needed for success? In this workshop I will detail my experiences teaching a course in anatomy study skills to undergraduates. I will demonstrate several of the in- and out-of-class activities used in this course, as well as discuss student feedback and data collected. The workshop will deal with my experiences in the first two semesters of this new course, and will focus in lessons learned and future directions for this course. I will also discuss ways of incorporating study skills instruction in an already busy curriculum.

710 (Room FS 2.520) – You Can’t Teach Them If You Can’t Keep Them: Improving Retention in A&P I – 60 Minutes
Karen Hlinka, West Kentucky Community and Technical College, karen.hlinka@kctcs.edu
Insights derived from retention and cognitive development theories led to implementation of practices purposefully designed to increase students’ feelings of validity, encourage active learning, and guide the processing of course content beyond memorization to deeper levels of learning and application. Revisions in attendance, withdrawal, and course repeat polices were undertaken to promote retention. A “Prep for A&P” course was developed to build skills prior to taking or re-taking A&P I. These efforts have resulted in a steady increase in retention rates. Come prepared to share your own retention strategies.
Wednesday, Session 8

801 (Room BV 3.306) – Adaptations for Lab-Based Online Anatomy and Physiology Courses – 90 Minutes
Norma Hollebeke, Carolina Biological Supply, norma.hollebeke@carolina.com, Stephanie Songer, Carolina Biological Supply, stephanie.songer@carolina.com
*Sponsored by Carolina Biological Supply*
Science education has been challenged by the rapid growth of online instruction. Using lab kits as part of a hands-on approach to online A&P courses infuses active learning and emphasizes student engagement. We will explore ideas to adopt and adapt a hands-on, inquiry model for online biology labs that achieve essential lab skills and learning outcomes. Participants will actively take part in hands-on lab investigations developed for online A&P courses. These investigations have been designed for the off-campus setting while maintaining the college-level rigor.

802 (Room BV 3.318) – Adaptive Learning in A&P: From Reading Assignments to Lab Prep, Tailor their Learning and Hold them Accountable – 90 Minutes
Steve Sullivan, Bucks County Community College, stephen.sullivan@bucks.edu
*Sponsored by McGraw Hill Higher Education*
Adaptive learning is a method of education that personalizes learning by continually assessing students’ knowledge, skill and confidence levels, allowing the design of targeted study paths based on those data. This helps instructors bolster students’ understanding in the areas where they need to improve the most. By helping students to focus their outside-of-class study time on the topics and concepts that are most challenging to them, adaptive learning has been shown to help students study more efficiently, develop greater proficiency, and earn better grades (ideal for traditional, hybrid, online, or flipped classroom).

803 (Room BV 3.326) – Connecting Art and Science: The Cultural History of Art and Anatomy in Italy – 90 Minutes
Kevin Petti, San Diego Miramar College, kpetti@sdccd.edu
*Sponsored by HAPS-Institute*
Italy’s medieval universities established the study of human anatomy for physicians. To heighten their art, Renaissance masters clandestinely conducted human dissection. The connection between art and science is best demonstrated by Michelangelo’s genius. Indeed, the wooden crucifix he carved in gratitude for secret access to corpses still hangs in the Basilica of Santo Spirito in Florence. This lecture tells the story of anatomy as an academic discipline, and its connection to art and culture. Learn how to apply these interdisciplinary ideas into your classes, and how you can travel to Italy in a HAPS-I course that lives this lecture.

804 (Room BV 3.328) – Validating and Norming Assessment Rubrics – 90 Minutes
Margaret Weck, St. Louis College of Pharmacy, Margaret.Weck@stlcop.edu
Currently program assessment depends heavily on rubric scoring of student work samples. In this workshop we will briefly review the fundamental principles behind determining the validity and reliability of “measurements” of learning based on rubric scoring. Following the review of principles the participants will engage as content experts in examining the face validity and content validity of a rubric for conceptual understanding of scientific and mathematical principles. Implications for development of rubrics tailored to the needs of participants’ programs and home institutions.

805 (Room BV 3.330) – The State of Online Anatomy & Physiology Lecture/Lab Course Delivery: Are We Ready for Prime Time? – 90 Minutes
Shari L. Gray, Regis College, shari.gray@regiscollege.edu, Ellen Lathrop-Davis, CCBC - Catonsville, elathrop@ccbcmd.edu, David Evans, Penn College, devans@pct.edu, Ewa Gorski, CCBC-Catonsville, egorski@ccbcmd.edu, Tom Lehman, Coconino Community College, tom.lehman@coconino.edu, Robert Leopard, Monroe Community College, rleopard@monroecce.edu, Betsy Ott, Tyler Junior College, bott@tjc.edu
Online learning is now firmly rooted in higher education but can this modality be done well with laboratory sciences? A&P, as a discipline, has its share of pioneers exploring the best ways to design a two semester course sequence with rigorous laboratory exercises comparable with traditional in-class/lab offerings. This panel discussion will provide a forum for HAPS attendees to discuss best practices – currently in use or proposed – for A&P hybrid courses (online lectures/on-campus labs) and fully online courses with online labs. The goal is to ensure these courses will meet HAPS Learning Outcomes and satisfy the Distributed Learning Position Statement.
806 (Room DB 2.228) – Screencasts & Lecture Capture – Tips and Best Practices – 90 Minutes
Janet Casagrand, University of Colorado, Boulder, Janet.Casagrand@colorado.edu
Have you ever wanted an easy way to create instructional videos (screencasts) for your students -- to answer frequently asked questions, review prerequisite concepts, cover concepts that require more time than you have in class, show problem solutions, or communicate with students in a different way? Or to record your lectures so students can review them later? This workshop will discuss options, tips and best practices for creating screencasts and performing lecture capture. Participants should bring a laptop.

807 (Room DB 2.304) – Students Helping Students Engage and Succeed in Anatomy and Physiology: A Pilot Study of a Peer-Assisted Learning Program – 90 Minutes
Sarah Blank, Berea College, sarah_blank@berea.edu, Chioma Amaechi, Berea College, Chioma_Amaechi@berea.edu, Willie Gosnell, Berea College, Willie_Gosnell@berea.edu, Gladys Kamau, Berea College, Gladys_Kamau@berea.edu, Yunpeng Xia, Berea College, Yunpeng_Xia@berea.edu
A pilot study was designed to compare student success between A&P courses taught with or without an associated Peer-Assisted Learning (PAL) program. Following a presentation of the preliminary findings by PAL leaders, participants will be provided an opportunity to engage in innovative educational manipulatives and games that were created and used in PAL sessions to make learning A&P fun and effective. Preliminary data suggest that the PAL program was beneficial to both A&P I and II students as well as to PAL leaders. If you have too many unsuccessful students in your A&P course, this workshop is for you.

808 (Room DB 2.306) – From “What’s a Humerus?” to “No two Deltoid Tuberosities are Created Equal” or Teaching Anatomy Labs Effectively at All Four Levels. – 90 Minutes
Molly O'Shaughnessy, Oregon Institute of Technology, molly.oshbaughnessy@oit.edu, Greg Pak, Lloyd Parratt, Oregon Institute of Technology, greg.pak@oit.edu, Hui-Yun Li, Oregon Institute of Technology, lloyd.parratt@oit.edu
At Oregon Tech, anatomy and physiology is taught at all four levels, to students on a variety of career paths. Our teaching at all of these levels emphasizes hands-on laboratories. We will demonstrate how we use the same resources (models and cadavers) with different expectations at each level. Activities target a variety of learning styles; you’ll learn what yours is and how to use it to modify your teaching. Come experience some techniques from our bag of tricks and share with us some of your favorites.

809 (Room DB 3.316) – Tubes and Twists: A Hands-on Activity to Teach Development of the Digestive System – 90 Minutes
Keely Cassidy, Indiana University, kmcassid@indiana.edu
When learning about digestive system development, students are often frustrated by how the simple gut tube changes shape, size, orientation, and direction in order to form the adult organs -- all while planning to fit neatly inside the abdominal cavity! How do we teach this without overwhelming our both students and ourselves? This workshop will begin with a discussion of teaching embryological topics using hands-on techniques. Then using simple and inexpensive materials (supplied by presenter for the first 10 participants) that can be found in any office or classroom, participants will create a tried-and-true learning tool that can be used in their own courses.

810 (Room FS 1.512) – A “How-to” Guide for Developing a Publishable Scholarship of Teaching Project – 90 Minutes
Valerie D. O’Loughlin, Indiana University, vdean@indiana.edu
*HAPS Presidential Initiative*
Have you altered some aspect of your teaching to achieve greater student learning? Have you wondered if these attempts were successful, and how you could document your findings? As part of the Presidential Initiative: Expanding A&P Educational Research in HAPS; Past President Valerie O’Loughlin will discuss performing pedagogical research. We’ll explore developing a clear research hypothesis, reviewing the literature, obtaining Human Subjects approval, and determining appropriate methods of assessment. Participants will work in groups and come prepared with a hypothesis they want to test. Each participant will leave with a refined research hypothesis and potential assessments to test the hypothesis. (Note: attendance to this workshop is REQUIRED for those participating in the HAPS-I course on Educational Research methods.)