Title: Efficacy of Online Learning Modules in a Large Undergraduate Anatomy Class

Principle Investigator: Polly Husmann,
Medical Sciences Department

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Funding level: Phase I

Duration: 1 ½ years
Abstract:

Anatomy A215: Basic Human Anatomy uses online LearnSmart modules to inform students of expectations and encourage them to participate in spaced retrieval practice. Each module consists of a variety of questions covering one book chapter or one section of a book chapter. The modules also ask the students how confident they are in their answers to the questions and then provide immediate feedback to the student on the accuracy of his/her response. This project will evaluate the impact of these online modules and begin to determine which aspects of the modules are actually benefitting the students (e.g., associated extra credit, time on task, improving metacognition). It will evaluate the number of modules completed, the amount of time spent on modules, the accuracy of responses to the module questions, and the students’ reported confidence in his/her answers. The variables will also be correlated with final percentages in the course and changes in accuracy and confidence across the semester will be tracked. Our goal is to determine if these modules are benefitting our students and if so, which aspects of the modules are most valuable. This information will allow us to better emphasize the aspects of the modules that make a difference for our students and will also inform us about how to better help our students in the classroom. Our larger goals are to provide a model for improving student metacognitive skills in a large undergraduate lecture class, since these skills are essential for academic success, and to determine how out-of-class technology might be used in this endeavor.
Purpose of the investigation along with specific research objectives:

The ability of a student to plan, monitor, and evaluate their learning is imperative to their academic success (Lindner and Harris 1992; Kruger and Dunning 1999; Ross et al. 2006; Terrell 2006; Thiede et al. 2009; Tobias and Everson 2009; Burman, Boscardin, and Van Schaik 2014; Hall et al. 2016; Wagener 2016). The most effective instruction for these metacognitive skills is to provide the student with both knowledge of the process and practice in using them (Kruger and Dunning 1999; Livingston 2003; Gooding, Mann, and Armstrong 2016). To this end, online LearnSmart modules were incorporated into the Anatomy A215: Basic Human Anatomy class in the fall of 2013 to provide students with more opportunities to practice these skills. Each online module covers a single chapter in the book by asking the student a variety of multiple choice, matching, rank order, and multiple answer questions. For each question, students are also asked to rank their confidence for their answer on a four option Likert scale. It is hoped that these modules will also help to increase the self-efficacy of the students by better acquainting them with the level of detail and types of questions present on examinations, and providing the students with informational feedback. This informational feedback has been shown to increase self-efficacy and metacognitive skills, and thus academic success (Schraw, Crippen, and Hartley 2006; Zimmerman and Moylan 2009; El Saadawi et al. 2010). The present research will address the following questions:

1) Is there a correlation between the number of LearnSmarts completed and final percentage in the course? If so, in which direction (i.e., positive or negative) and how strong is that correlation?

   *Rationale:* Evaluating this question will allow us to see if the LearnSmart modules as a whole are having an impact on grades and if so, what that impact is. Is it taking time away from other study strategies that would be more effective for the student? Unlikely. Is it helping them to recognize the goal and work at a more regular pace toward it? Hopefully. This is the first step of assessing the overall impact of the LearnSmart modules.

2) Is there a correlation between the amount of time that a student spends on the LearnSmart activities and the final percentage in the course? Again, if so, in which direction and how strong?

   *Rationale:* Assessing the amount of time that the students are spending on the LearnSmart modules will both give us a better idea of how much we are asking of our students and will also help to parse out how much of the effect (assuming there is one) may simply relate to increased time on task (i.e., working with the material).

3) Is there a correlation between the average confidence that a student reports on his or her LearnSmart modules and his/her final percentage in the course? And again, if so, in which direction and how strong?

   *Rationale:* Previous studies have found that students, especially students who are not doing well, tend to be overconfident about their knowledge of the material (Lundeberg and Mohan...
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2009; Sawdon and Finn 2014). Is this true for our students? Does completing the LearnSmart modules help to better calibrate this self-assessment?

4) How accurate is students’ confidence in their answers (i.e., are they right when they think they’re right? Wrong when they think they’re wrong?) and does that accuracy increase throughout the semester? Does this confidence lead to improved self-efficacy (i.e., do they become more confident of the answers that are correct)? If so, is there a minimum number of LearnSmart modules that must be completed for these effects to occur?

Rationale: Previous studies have found that practice monitoring and evaluating one’s learning helps to better calibrate that student’s self-assessment skills (Huff and Nietfeld 2009). In turn, improving these skills has also been found to improve class performance. However, it may require multiple rounds of practice before this calibration improves (Nietfeld, Cao, and Osborne 2006). If these modules do help students to calibrate their self-assessment, knowing how many modules are necessary to see these effects would provide better information for the class instructors about the minimum number of modules that need to be assigned in order for these improvements to occur.

Research methodology:

Class set-up

Anatomy A215: Basic Human Anatomy is a large (400+), 5-credit hour undergraduate class that has both lecture and lab components. The lecture component meets three times a week for fifty minutes in a large lecture hall. The lab component meets twice a week with approximately thirty-six students led by two graduate associate instructors and one undergraduate teaching assistant. The lecture is a fairly traditional lecture with approximately two or three brief learning activities (e.g., memory matrices, think-pair-share, rank order questions) interspersed throughout the lecture. The lab is more independent with a brief (15-20 minutes) intro to the lab followed by self-directed learning on bones, models, virtual microscope slides, and two prosected cadavers as guided by the instructors and lab manual. Lecture assessments include ten five-point online multiple choice quizzes (lowest two are dropped from the final grade for a final total of forty points) and four multiple choice exams worth ninety points each. Lab assessments are composed of four exams each worth one hundred points and each asking forty short answer questions based on the bones, models, cadavers, and virtual microscope slides. The final point total for the class is eight hundred points and the class is composed mainly of students interested in healthcare with the most common majors being Exercise Science, Biology, and Nursing (Schutte 2016).

LearnSmart set-up
Online LearnSmart modules were implemented as optional extra credit assignments for the Anatomy A215: Basic Human Anatomy class in the fall of 2013. These modules came as part of a package from McGraw-Hill Education when we moved from a paper textbook to an electronic textbook for the class. Each online module asks questions over a chapter or section of a chapter (if the chapter was split across multiple exams). These formative quizzes include a variety of multiple choice, matching, rank order, fill-in-the-blank, and multiple answer questions. For each question, students are also asked to rank their confidence for their answer on a four point Likert scale including “I know it”, “I think so”, “Unsure”, and “No idea”. After the student has indicated his/her confidence level, the module will then provide immediate feedback on the accuracy of their response. The modules range in length from nine questions to seventy-seven questions with a mean of 42.73 and a median of forty questions. The modules are open notes and the students are encouraged to use the textbook (e-book) that is linked to the modules. It is also acceptable for students to discuss the questions with other students, though this is not emphasized in class.

For Basic Human Anatomy these modules are assigned as self-study and worth up to two extra credit points based on completeness. However, not all of these bonus points will ultimately be transferred to the student’s grade. After each exam, two of the LearnSmart modules from that exam’s block of material will be chosen to be included in the grade as extra credit. (The students do not know which two modules will be chosen prior to the due dates for the modules.) The points that a student earned on these two (and only these two) LearnSmart modules from each block will be added to the student’s grade for a semester total of sixteen extra credit points (2 LearnSmarts * 4 exam blocks * up to 2 points each). These points are added to the student’s final score in the class. In addition, not every block has the same number of LearnSmart modules assigned. The exam 1 block has seven modules assigned while the exam 2 block as six modules assigned. The exam 3 block has nine modules assigned and the exam 4 block has four modules assigned. Thus, the likelihood of a single module being chosen to receive credit also varies across the different exam blocks. During the Fall 2015 semester, the number of students that submitted a given module (i.e., completed at least part of the module prior to the deadline) ranged between 227/394 and 393/421 (difference in base numbers due to student drop-out) with a mean of 277.35 students receiving at least some credit for the module.

Data collection

For this study, the following data will be collected from the McGraw-Hill LearnSmart reports for each student: 1) number of LearnSmart modules completed, 2) amount of time spent on LearnSmart modules, 3) percent of answers correct and aware (confident), 4) percent incorrect and aware (not confident), 5) percent correct and unaware (not confident), 6) percent incorrect and unaware (confident). Unfortunately, the current LearnSmart algorithms only report this information in aggregate for all LearnSmart modules completed. Thus, every time the student completes another module, that data is simply added in. I have previously contacted the company, but unfortunately they do not keep the individual module records either. As such, the data must be harvested on a regular basis. For this project, the reports will be downloaded daily to the extent possible. The data will then be evaluated for new LearnSmarts that have been completed and the new data pieced out to determine which data are from which individual modules as much as possible.
Statistical Analyses

The data will then be analyzed using SPSS 24. After evaluating the assumptions of the statistical tests, either parametric or non-parametric correlations will be run to determine the relationships among final course percentages, number of modules completed, time spent, and confidence data. Multiple regression analyses will also be completed to assess which variables are providing additional or unique data to predict the final percentage in the course.

Outcomes and contributions to student learning at IU

The specific outcomes of this research are as follows:

1. To evaluate the efficacy of LearnSmart modules for both content knowledge and metacognitive skills – This will continue our endeavor to make A215 the best and most student-friendly course possible given the necessary constraints.

2. To create a model for other courses on how out-of-class technology may improve the student experience via self-reflection and immediate feedback – By determining which of these aspects of the LearnSmart (time, content, self-reflections, etc.) are associated with success, we can then transfer this knowledge to help improve other courses as well.

3. Add to the current body of literature on the use of out-of-class technology to improve metacognition/self-efficacy in large lecture undergraduate classes – By evaluating the confidence assessments associated with the online modules, we can assess the use of out-of-class online modules to help students develop their self-efficacy and/or metacognitive skills. This information may then transfer to help improve other courses, especially other large undergraduate lecture courses, and to help the students develop as learners.

Significance and impact the study may have on undergraduate teaching and learning

On a broad scale, this research will contribute to our growing understanding of undergraduate metacognition, cognitive development, and out-of-class study habits. This project will provide insight to determine if out-of-class online assignments are an effective means of increasing student understanding of content and/or their own metacognitive skills. It will provide insight to determine if students’ self-assessment accuracy improves with online learning modules and if so, to determine how many modules are necessary to see that improvement. Finally, it will allow us to begin to tease out which aspects of the LearnSmart modules (if any) are truly benefiting our students and it will point us towards improvements that can be made to these programs and/or strengths of the programs that can be further emphasized. For example, some research has suggested that adding some additional questions or instruction on metacognition and scaffolding may improve the efficacy of online LearnSmart modules (Thadani and
Bouvier-Brown 2016). Is this necessary? First, we must investigate what benefits our students are currently receiving from the online modules themselves.

On a local level, this project will allow us to evaluate whether or not to continue using the LearnSmart activities. It will help the participating students to become better self-regulated learners by demonstrating the advantages of spaced retrieval practice and self-reflection. These are attributes that may then be transferred to their other classes, and ultimately professions, as well.

**Measures of Success**

I will consider this project successful if we are able to parse out the confidence data by individual LearnSmart module. From this data, we can then evaluate trends in LearnSmart results and final percentage data, which will enable us to make more informed decisions about their use in the course. I will further consider this project successful if we are able to present and/or publish the outcomes and receive positive feedback. Ultimately, I would consider this project extremely successful if it allows us to delve deeper into future projects that examine the LearnSmart modules and/or our students’ metacognitive development.

**Dissemination of Results**

In addition to participating in SOTL-related activities at IUB, the results of this project will be disseminated via conference posters or presentations at both regional conferences (e.g., E.C. Moore symposium) and national conferences (e.g., Human Anatomy & Physiology Society annual meeting). The results will also be submitted as a manuscript for publication in a scholarly journal, such as *Anatomical Sciences Education*.

**Reflective Teaching Practices**

The results of this project will allow the instructors to reflect on our use of LearnSmart modules for Basic Human Anatomy. Based on the knowledge gains from this project, we will drop, maintain, or revise our current use of the LearnSmart modules to better help our students in future iterations of the course. The results of this project will also enable the instructors for this course to have a better understanding of which parts of the LearnSmart modules benefit our students and reflect on better ways to emphasize these aspects and/or skills.
References


Terrell, Mark. 2006. 'Anatomy of Learning: Instructional Design Principles for the Anatomical Sciences', The Anatomical Record (Part B), 2898: 252-60.


Wagener, Bastien. 2016. 'Metacognitive Monitoring and Academic Performance in College', *College Teaching*, 64: 47-54.

The funds from a SOTL grant would be used for two purposes: 1) for a graduate assistant to help with the project, especially with the data collection and analysis, and 2) for both the graduate assistant and myself to attend and present our findings at the Human Anatomy & Physiology Society (HAPS) annual meeting in Columbus, Ohio in May of 2018.

For the graduate assistant, I have designated that I would pay him/her fifteen dollars per hour. During the fall semester, I have budgeted one hour for an initial meeting to explain the project and one final meeting at the end of the semester to discuss future plans and analysis. I have also designated one hour per week throughout the semester for data collection. This assumes that the assistant is downloading the data a minimum of six times per week and that the downloading only requires a few minutes each time. In the spring semester, I have designated three hours per week for the graduate assistant. During that time the assistant would be working through the data (with me as much as necessary) to parse out which data (confidence data and scores) go with which LearnSmart for each individual student. Once this is complete, the assistant will then help to run the initial statistics and prepare a poster for presentation at the HAPS meeting in May.

For the HAPS meeting, I am assuming that I would drive my own car and that the assistant would ride with me. The distance is based off of a Google maps query (https://www.google.com/maps). I used the
mileage rate indicated by IU Travel (http://www.indiana.edu/~travel/traveling/travelingbycar.shtml). I have also designated funds for hotel rooms assuming double occupancy (the assistant would not have to room with me specifically as we do have other faculty and graduate students from our department that also attend this meeting). All hotel and per diem rates are based on www.gsa.gov rates for Columbus, OH (as forwarded from IU Travel). The remainder of the necessary funds will come from departmental conference allotments, if possible, or out-of-pocket.
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Project Timeline

- January 2018: receive funding
- Spring/Summer 2018: recruit graduate assistant
- August 2018: meet with graduate assistant to discuss roles and expectations
- Fall 2018:
  - Collect data from web daily
  - Check in with graduate assistant weekly to address any obstacles or complications
- December 2018:
  - Wrap up data collection
  - Meet with graduate assistant to discuss current data and future plans
- January 2019: organize and begin to analyze data
- February 2019:
  - Continue analysis
  - Submit abstract for HAPS meeting
- March-April 2019:
  - Finalize analysis
  - Create poster for HAPS meeting
- May 2019: present poster at HAPS meeting in Columbus, Ohio
- Summer 2019:
  - Write-up manuscript for publication
  - Submit final report to SOTL
EDUCATION:

GRADUATE
Indiana University
Ph.D.
May 2011

Indiana University
MS
May 2010

UNDERGRADUATE
University of Notre Dame
BA
May 2005

APPOINTMENTS:

Indiana University School of Medicine (IUSM)
Asst Professor
July 2015 – present

Case Western Reserve University
Asst Professor
June 2013 – June 2015
School of Medicine (CWRU)

Ashland University (AU)
Visiting Asst Professor
August 2012 – May 2013

West Virginia School of Osteopathic Medicine
Asst Professor
June 2011 – June 2012
(WVSOM)

PROFESSIONAL ORGANIZATION MEMBERSHIPS:

American Association of Anatomists 2009 – present
Human Anatomy & Physiology Society 2014 – present
American Association of Physical Anthropologists
Paleopathology Association

TEACHING:

TEACHING ASSIGNMENTS:

UNDERGRADUATE
Course #  Short Title
A215  Basic Human Anatomy
Role: Instructor
Credit Hours: 5
Term: Fall, Summer II sessions
Enrollment: 400+ fall and spring, 50-60 in summer
Responsibilities: Lecturing and helping to coordinate the course while attempting to utilize as many active learning techniques as possible
MSCI M131  Disease and the Human Body  Indiana University, Bloomington
Role: Instructor
Credit Hours: 3
Term: Spring
Enrollment: ~75
Responsibilities: Lecturing and managing assessments for my quarter of the course, which is designed to fulfill science and math credits for non-majors.

GRADUATE
Course #  Short Title
ANAT A620  Human Structure  Indiana University School of Medicine
Role: Instructor
Credit Hours: 8
Term: Fall
Enrollment: 35-40
Responsibilities: Teaching gross anatomy and embryology to first year medical and graduate students via lectures, labs, case studies, and active learning techniques as part of an integrated medical curriculum

A550-551  Medical Gross Anatomy  Indiana University School of Medicine
Role: Instructor
Credit Hours: 4/semester (2 semester course)
Term: Fall & Spring semesters
Enrollment: 35-40
Responsibilities: Teaching anatomy to first year medical and graduate students via lectures, labs, case-based learning, team-based learning, and flipped-classroom techniques

MENTORING:
Individual  Role  Inclusive Dates
Keely Cassidy  Committee Member  Fall 2015 – Spring 2016
Paige Wojcik  Committee Member  Fall 2015 – present
Savannah Leach  Committee Member  Fall 2015 – present

GRANTS/FELLOWSHIPS IN TEACHING:
ACTIVE TEACHING GRANTS/FELLOWSHIPS
Title  Granting Agency  Role  Amount  Dates
Anatomy Education Research Institute (AERI)  American Association of Anatomists (AAA)  Co-PI  $50,000  10/2015-present

INVITED PRESENTATIONS – TEACHING
LOCAL
Title  Organization  Date
Husmann PR  Indiana University  Feb. 2016
Issues in Teaching & Pedagogy:
What is the Future of Teaching?
Preparing Future Faculty Conference (Bloomington, IN)

NATIONAL
Title  Organization  Date
Husmann PR & Barger JB  American Association of Anatomists  April 2014
Study Skills in Anatomy & Physiology:
What’s the Difference?
Experimental Biology Meeting (San Diego, CA)

Husmann PR  Paleopathology Association  April 2012
Student Job Talk Panel  Annual Meeting (Portland, OR)
Husmann PR & Barger JB
Medical Student Study Skills in Anatomy & Physiology: Is There a Difference?*
American Association of Anatomists Experimental Biology Meeting (Washington, DC) April 2011

* indicates a poster

RESEARCH/CREATIVE ACTIVITY:

INVITED PRESENTATIONS – RESEARCH

LOCAL

Title Organization Date
Husmann, PR Anthropology Graduate Student Association Feb. 2011
The Technology of Maize Production: Annual Symposium (Bloomington, IN)
Changes in Physical Activity with the Transition to Agriculture in the Midwest

Husmann, PR Midwest Archaeological Conference October 2010
Osteoporosis in an Archaeological Annual Meeting (Bloomington, IN)
Population: A New Method of Analysis

NATIONAL

Title Organization Date
Spencer SD, Husmann PR, & Cook DC Paleopathology Association April 2013
Contribution of Osteoporosis to Fracture Annual Meeting (Knoxville, TN)
Patterns among Pre-Columbian Amerindians of West-Central Illinois

Husmann PR American Association of Physical April 2012
Changing Gender Roles in Prehistoric Anthropologists Annual Meeting (Portland, OR)
America: Physical Activity with the Transition to Agriculture in the Midwest*

Husmann PR Paleopathology Association April 2012
Food, Fitness, & Fractures: Osteoporosis Annual Meeting (Portland, OR)
during the Transition to Agriculture in the Lower Illinois River Valley

Husmann PR American Association of Anatomists April 2010
Death is Only the Beginning: Experimental Biology Meeting (Anaheim, CA)
Cadaver Use at Indiana University*

*indicates a poster

SERVICE:

UNIVERSITY SERVICE:

DEPARTMENT

Activity Role Inclusive Dates
Associate Instructor Committee Committee Chair Fall 2016 – present
○ Manage and determine roles for 20+ associate instructors each semester
Undergraduate Education Committee Member Fall 2015 – present
○ Oversee the undergraduate curriculum in the Medical Science Program, including the evaluation of newly proposed courses for our undergraduates
Website Committee  
Committee Member  
Fall 2015 – present
- Represent the Anatomy Education track interests on the Bloomington campus, Indiana University School of Medicine webpage. Maintain the website information about pedagogical research within the Medical Sciences Program

PROFESSIONAL SERVICE:

LOCAL
Organization  
Role  
Inclusive Dates
Medical Sciences Program  
Advisor  
Fall 2015 – present
- Serve as the local advisor for four medical students every other year

NATIONAL
Organization  
Role  
Inclusive Dates
American Association of Anatomists (AAA)  
Professional Development Committee  
Spring 2015 – Spring 2018
American Association of Anatomists (AAA)  
Symposium Chair  
Spring 2016
American Association of Anatomists (AAA)  
Advisory Committee for Young Anatomists (ACYA)  
Spring 2011 – Spring 2014
American Association of Anatomists (AAA)  
Educational Affairs Committee liaison from ACYA  
Spring 2011 – Spring 2014

PUBLICATIONS:

TEACHING
Refereed


Non-refereed

RESEARCH/CREATIVE ACTIVITY
Refereed

10/28/2016 (Date)  
(Signature of Candidate)
October 27, 2016

Center for Innovative Teaching and Learning
Herman B Wells Library
2nd Floor, East Tower
1320 East Tenth Street
Bloomington, IN 47405

To Whom It May Concern:

I am absolutely delighted to support the application by Dr. Polly Husmann evaluating the use of online LearnSmart modules in our Anatomy A215: Basic Human Anatomy course.

The proposed project is a valuable addition to our community as it will work to improve both our A215 course and the development of our students as learners. A215 is a large lecture-based class in which it is difficult for students to receive individualized feedback on either their content knowledge or their learning process. By assessing the benefits of the online modules, we can develop better mechanisms for encouraging and prompting our students in the ways most strongly correlated with their academic success.

Dr. Husmann joined our department in 2015 and is an outstanding teacher. She has previously completed research in the study habits and online resources that students use for our A215 class, which she has presented at conferences and published in *Anatomical Sciences Education* (Husmann, O’Loughlin, and Braun 2009). The current proposal builds on this previous experience. By assessing the benefits of the online modules that students are now completing, she will also be able to transfer this data to improve other courses, both at IU and beyond.

The department fully supports this work and is confident that Dr. Husmann will provide valuable insights into the scholarship of learning based on her study.

Thank you for your careful consideration of her work.

Sincerely,

John B. Watkins, III, Ph.D.
Associate Dean
Director of Medical Sciences
Professor of Pharmacology and Toxicology