

## Human Anatomy and Physiology (BIOL 2451K) Course Redesign at Georgia Gwinnett College

### Using Student-Faculty Contracts and Self-Monitoring to Increase Student Success in Anatomy and Physiology I

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Human Anatomy and Physiology I (API) is a gateway course to careers in allied health. In order to be competitive for nursing, medical, and physical therapy programs, students need to be successful in API. Yet, most students have not had the experience with the rigor and substantial content of material that is required for this course. In this case study, we used known theories of behavior change that have worked in allied health to improve student success. The results of the study have implications for how and when students are taught accounting topics and the effect on their academic performance.

#### STATEMENT OF THE PROBLEM

Anatomy and Physiology I (API) is a gateway class to careers in allied health. Nationally, Human Anatomy and Physiology courses are believed to have among the worst undergraduate course failure and withdrawal rates (Hopper, 2011). Success in Anatomy and Physiology courses has been shown to be an excellent predictor of success in nursing programs (Lewis & Lewis, 2000). Therefore, in order to be competitive for admission to nursing, medical, or physical therapy programs, students need to be successful in API. Based on personal experience, most students are not prepared for and have not had experience with the rigor that comes with API in which 16 substantial chapters of material are required in 15 weeks' time. In this case study, we used known theories of behavior change such as Contract Learning and component of Self-Regulation known as self-monitoring (timecards) that have worked to improve student success (Frank & Scharff, 2013; Sebesta, & Speth, 2017). In order to perform well in API, students need to hold themselves accountable and also know exactly what will be required of them in order for them to be successful. Many students underestimate the time required to learn large amounts of material (Bash & Kreiner, 2014), which can lead to time management issues and poor performance. To make students more self-aware of their actual study time, students were required to keep timecards of their study time for API. Data suggest that students who study longer hours (Sturges et al., 2016) and work less hours (Harris et al., 2004) are more successful in Anatomy and Physiology classes. Thus, the contract and timecard intervention serve to provide students with much needed understanding of the rigors of this class.

## METHODS

Students were required to sign a Student-Faculty Communication sheet (learning contract) indicating they were aware of the requirements to do well in the class. Seven items of importance were listed on the contract ranging from acknowledgement of the importance of attendance, due dates, integrity, and how to contact the professor. The most relevant statement they acknowledged indicated that they would need to study about 2-3 hours per day for the course to learn the material required adequately to perform well.

To make students more self-aware of their actual study time, they were required to keep timecards of their study time for API. Students were to include the date and time they began each study session and also the exact time each session was completed. Each log entry had the number of minutes of study tabulated and was summed for the week. Students were made aware that as long as they performed the task as stated they would earn full credit and they were to be honest and accurate.

During the first semester that this intervention was used, Anatomy and Physiology I students taught by one professor in 2 sections were given a Student Faculty Communication Sheet during the second week of class (after the add/drop period). In subsequent semesters (2 class sections of data), students were required to keep timecards in addition to the Student Faculty Communication Sheet. Relatively nothing major changed in teaching. Grades were compared with the previous classes taught by this professor (5 sections).

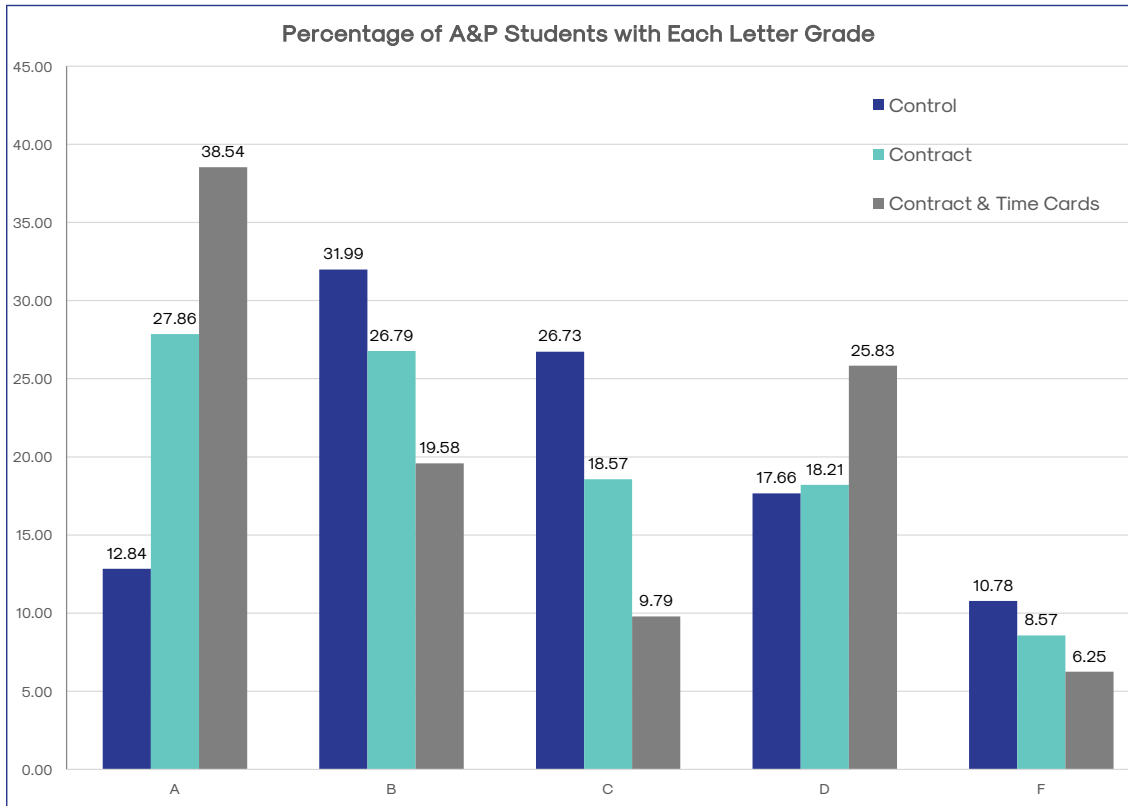
## OUTCOMES

Percentage of course grades (A-F) are presented in Figure 1 for the control period (5 sections), contract only (2 sections) and contract + timecards (2 sections). The data demonstrate that percentage of As earned was increased (up to 3 times the amount) in classes with the contract + timecard when compared to the control class sections. Additionally, for the most current semester (1 section), when correlating the amount of time spent studying and the course grade (expressed as a percentage of total points), a positive correlation is demonstrated ( $r = 0.60$ ) (Figure 2). Study time does not explain all the variance in student success. Factors such as study skills, sleep, motivation (Sturges et al., 2016), previous educational experiences (Harris et al., 2004), among others, likely play a pivotal role as well. We also do not know the accuracy with which all students indicated they studied, which could have influenced the outcomes. Students have indicated initially they did not understand why (even though it was explained in detail) logging their time would improve their success in the course, but they noticed the difference and their success in the class was directly related to the amount of study and dedication to learning the material outside of class.

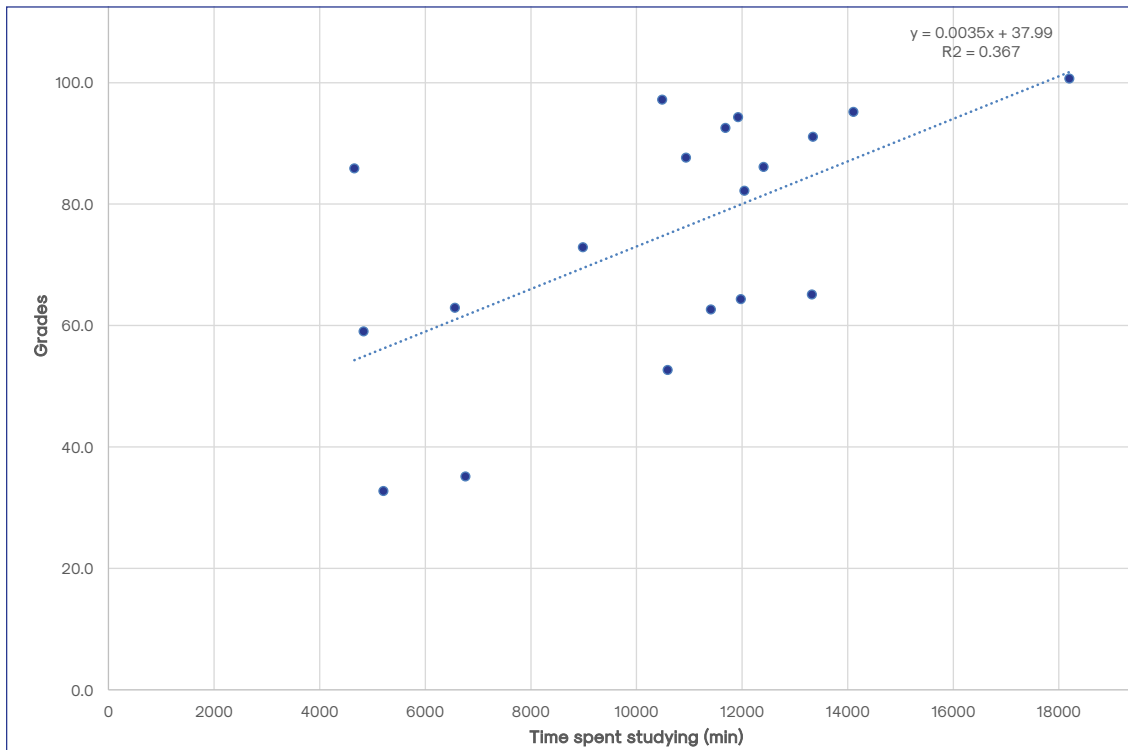
## PLANS FOR CONTINUATION AND EXPANSION

The contract + timecard intervention will be rolled out to six faculty teaching 12 sections in the 2020-2021 academic year. With this larger roll out, we will be able to address issues related to teaching styles (e.g. hybrid, online, face-to-face) and student demographics that may affect equitable outcomes (e.g. gender, ethnicity, first generation status, repeat status, previous GPA, number of credits during the semester, work hours). We will also be able to follow students into the next semester to determine if this intervention affects Human Anatomy and Physiology II course grades.

**Figure 1**  
*Percentage of A&P Students with Each Letter Grade*



**Figure 2**  
*Time vs. Grades*



## LESSONS LEARNED AND POTENTIAL IMPLICATIONS

Students often underestimate the amount of time required to learn so adding the timecard component enhanced the findings over using the contract alone to allow students to visualize the amount of time they are devoting to studying. Additionally, given the rigor of this class, an understanding of student demographics influencing course grades will initiate further interventions targeted toward specific groups or suggestions related to specific preparation prior to taking this class. There are also numerous studies that indicate a contract can make people more aware of their behavior and result in a positive change. The results were a considerable increase in the number of As over previous semesters. It appears that making students more aware of what is required, how much they are studying, and requiring them to make a study schedule can result in improved performance and warrants further future investigation.

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# Human Anatomy and Physiology (BIOL 2451K) Course Redesign at Georgia Gwinnett College

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Problem-based learning (PBL) is used in healthcare professional programs because educators recognize students separate theoretical knowledge from practical knowledge. PBL equips pre-nursing students with active learning and scientific literacy competencies. In the current study, pilot sessions occurred in Spring 2020 with 2 PBL tutors and 10-15 students/session. Sessions included review, PBL activity, wrap up, and assessment. Participants (100%) felt the session length was just right. Most (89%) felt the PBL session increased their interest/skill level. All (100%) felt they studied more effectively and were more independent learners due to PBL sessions.

## STATEMENT OF THE PROBLEM

Problem-based learning (PBL) pedagogy focuses on students identifying and resolving problems from a real-case scenario, usually in small groups through self-directed learning facilitated by peer tutors (Li et al., 2019). PBL is often used in healthcare professional programs because healthcare professional educators recognize that students often separate theoretical knowledge (the knowing that) from practical knowledge (the knowing how) (Benner, 1984; Craddock, 1993, Ehrenberg & Haggblom, 2007) leading to a theory-practice gap. Researchers (Sockalingam & Schmidt, 2011; Li et al., 2019) suggested that contrasted to traditional curriculum that separates theory and practice and emphasizes memorization, PBL encourages students to develop critical and active learning skills. Zhang (2014) suggested that additional years of practice and consistency in tutoring could affect the outcome of students' problem-based learning experience. Thus, the earlier the introduction of PBL pedagogy, potentially the more successful pre-nursing students will be within their pre-nursing science classes as well as long-term in nursing school. Georgia Gwinnett College (GGC) has almost 1500 pre-nursing students. Many of these students struggle in BIOL 2451K and do not achieve the grades necessary to progress in their chosen career path. The DFW rate over the last 7 years is 36+5% representing over 100 students a semester (15 sections/semester of BIOL 2451K, 24 students/section) who cannot continue. BIOL 2451K is usually taken in the 2nd semester of a 4-semester sequence of pre-nursing science classes. Students performing poorly in this class risk obtaining admission to nursing schools and/or other allied health profession programs. Anecdotally, course faculty suggest that unsuccessful attempts in BIOL 2451K result from students utilizing rote memorization to learn the vast amount of material required

in this course. A PBL pedagogy may assist these potentially unsuccessful students to develop scientific literacy and active learning skills, which are critical to success in pre-nursing courses and ultimately in nursing school.

## METHODS

This program was designed to equip pre-nursing students with active learning and scientific literacy competencies. Senior level Chemistry, Biology, and/or Exercise Science students served as peer tutors (PBL leaders). Subject matter expert faculty developed modules that addressed specific topics related to BIOL 2451K, such as study skills, homeostasis, data graphing, histology, bony landmarks, joint movement analysis, muscular anatomy, muscle mechanics, action potentials, neural system functional losses, and somatosensory functions. These modules reflected topics within BIOL 2451K with which students often struggle. Each PBL session included a topic review portion (15 minutes), PBL activity (30 minutes), wrap-up activity (15 minutes), and assessment (15 minutes) for a total of 75 minutes. For example, in the bony landmark module, the topic review portion involved discussion of specific bony landmark definitions. The PBL activity involved small groups of students discussing a case study related to clinical issues of skeletal anatomy (e.g., fracture or dislocation). Within the PBL activity, students were to determine the bony landmarks associated with the skeletal anatomy within the case study. The wrap-up activity involved the PBL leader reviewing and answering questions. The assessment activity involved 5 opinion questions related to the PBL session structure and material. Each module was presented multiple times within a week to allow for BIOL 2451K students to go to a session that worked within their schedules. Peer tutors met with the subject matter expert faculty prior to the PBL sessions so that the peer tutors were ready to present the material for each session.

## OUTCOMES

Pilot sessions were started during the first part of Spring 2020 with 2 PBL leaders and approximately 10-15 students per session (total of 51 students participated in three modules). The modules that were presented were 1) bony landmarks, 2) joint movement analysis, and 3) muscle anatomy. Due to the campus closure caused by the COVID-19 virus, no further modules were able to be presented. In evaluating the session critique information, students (100% of respondents) felt that the length of the session was just right (75 minutes per session). Most (89% of respondents) felt that the PBL session increased their interest and skill level in the subject matter presented. All (100% of respondents) students felt that they were able to study more effectively and were more independent learners in the subject matter presented as a result of the PBL session. Further, the students who served as PBL leaders enhanced their academic and personal development through the development of leadership skills and scientific literacy.

## PLANS FOR CONTINUATION AND EXPANSION

Ultimately, the goal of this program is to demonstrate its effectiveness to expand it to all five pre-nursing science classes. Funding for the PBL leaders was obtained through an internal grant from the Provost's office which ended this semester (Spring 2020). Ultimately, for sustainability and expansion of the program, the development of a specific 4000 level course in which students who wish to be peer tutors will enroll for course credit is necessary, similarly to other campus programs like Peer Supplemental Instruction (PSI) peer leaders. This type of upper level course would be in consultation with our college's Academic Enhancement Center. Additionally, the PBL program enables students to focus on practical applications of the knowledge learned in class. Given that healthcare education programs (e.g., nursing,

medicine, physical therapy) often focus on integrated learning experiences, PBL program will enhance students' abilities to function in these types of environments. The GGC Nursing Program reported in the campus communication, *The Pulse*, that the GGC nursing program has used a "flipped classroom" model since its inception. The flipped classroom model "flips" the traditional relationship between class time and homework. Students learn at home via online coursework and lectures, and teachers use class time for teacher-guided practice or projects. Thus, the earlier the introduction of PBL pedagogy, potentially the more successful pre-nursing students will be within their pre-nursing science classes as well as long-term in nursing school.

## LESSONS LEARNED AND POTENTIAL IMPLICATIONS

First, hiring student workers is a very difficult AND time-consuming process so offering a 4000-level course for credit may be better. It took over 4 months to hire the students, which put our project over a semester behind. Next, finding and training PBL leaders is critical to the success of the program. While ideally, senior level Chemistry, Biology, and/or Exercise Science students would serve as PBL leaders, finding students who were successful in BIOL 2451K provided only a small sample. Students who were pre-nursing represented even a smaller number of students because these students were only available for 1-2 semesters following BIOL 2451K due to the demands of nursing schools. In our experience, advertisement and encouragement from faculty for attendance (potentially offering extra credit). Attendance for the sessions was mixed. With only 3 modules in the pilot study, it is not clear if a particular time is better for BIOL 2451K students. We had sessions during a campus class free time on Tuesdays as well as twice on Fridays (day with fewest classes). Some faculty offered extra credit to attend. Potentially, offering these modules within classes instead of separate sessions would reach more people but need buy-in from faculty to move toward a "flipped" class model. In order to provide the material to the greatest number of students, it may be more beneficial to get faculty to provide the sessions within their classes. This will require buy-in from BIOL 2451K who may not be familiar with the flipped class and/or resistant to alternative types of pedagogy.

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