

MasteringA&P, MyReadinessTest

School Name Muskegon Community College, Muskegon, MI

Course Name Anatomy and Physiology I

Course Format Face-to-face

Key Results Data from this study tentatively showed that scores from the MyReadinessTest diagnostic test identified students who may be at risk because they are less prepared at the onset of the course. Data also showed a strong positive correlation between MasteringA&P homework and exam scores ($r = 0.62$).

Submitted by
Shawn Macauley, Professor

Course materials
MasteringA&P, MyReadinessTest, and *Visual Anatomy and Physiology*, Frederic Martini

Setting

Muskegon Community College, initially founded as a junior college, officially became a community college in 1951. According to the *2013 Integrated Postsecondary Education Data System Data Feedback Report*, 25 percent of the school's nearly 7,500 students attended full-time. Of those, 57 percent received financial aid. For the 2009 cohort, the graduation rate was 15 percent, and the transfer rate was 42 percent of the cohort as a percent of total entering students.¹

Professor Shawn Macauley received his PhD in medical sciences, and has been teaching at Muskegon for seven years. He teaches all formats of anatomy and physiology, including face-to-face, hybrid, and online. He is interested in research on the effective use of technology in teaching introductory science classes, and currently teaches Anatomy and Physiology (A&P) I and II.

Anatomy and Physiology I is a four-credit lecture and laboratory course designed to meet the needs of students in nursing and other health-related fields. The course has no required prerequisites, but Macauley recommends that students complete Introduction to Chemistry, Introduction to Biology, and Medical Terminology before enrolling in A&P I. While students may take the lecture portion of the course online, all students are required to attend face-to-face labs on campus.

The course covers the normal structure and function of organs and organ systems of the body, including cell biology, histology,

and introductory anatomy and physiology of the integumentary, skeletal, muscular, nervous, digestive, lymphatic, cardiovascular, respiratory, urinary, endocrine, and reproductive systems. Upon successful completion of the course, students are allowed to enroll in Anatomy and Physiology II.

Challenges and Goals

Approximately 450 students per year take the course, and it has historically had a high failure and repeat rate: approximately 60 percent of students pass the course the first time. The lack of prerequisites or a required placement test contributed to a high number of students taking the course who were not prepared for the level of work required to succeed.

Macauley believed that the first steps to addressing the course's retention issue were to identify which students may be most at risk as early as possible and to provide content throughout the course that could enhance learning. To address these challenges and goals, he adopted MyReadinessTest for A&P and MasteringA&P in summer 2014. His plan was to administer the MyReadinessTest diagnostic test at the onset of the semester in order to gather data that would help identify students whose prerequisite skill levels were low. In addition, to address learning needs outside the classroom and thereby enhance student engagement and learning, Macauley implemented MasteringA&P with a variety of different types of assignments and activities throughout the semester.

Macauley began this study to start to test and measure the relationship between (1) performance on the MyReadinessTest diagnostic test and MasteringA&P assignments and (2) exam and course scores. In addition, as a way to measure how his students engaged with MasteringA&P resources, Macauley collected data related to the MyReadinessTest and MasteringA&P assignments. He believed that this data would help him further understand the relationship between student behavior and performance during the semester and course outcomes and completion rates.

¹<http://www.muskegoncc.edu/PDFFiles/Institutional%20Research/IPEDS-2013-Data-Feedback.pdf>.

Implementation

Macauley implemented MasteringA&P resources in a variety of ways in order to provide students with multiple opportunities to assess their understanding, and so they could use that information to guide study efforts. He set up the class so that students would do three or four MasteringA&P chapter assignments, take a MasteringA&P quiz, and then attempt an exam on that content. This format offers students several opportunities to engage with content before being assessed on it.

Following are the course components for the period of this study:

MyReadinessTest diagnostic pretest. Assigned during the first week of class, the diagnostic assignment comprised 70 questions that provided detailed information on each student's mastery and application of essential reading, writing, and math skills, and of core skills in anatomy and physiology, chemistry, and physics. A Study Plan was automatically generated for each student based on assignment performance. Use of the Study Plan was optional; students could use it on their own time if they wished to remediate on the topics that they missed.

MasteringA&P chapter assignments. Assignment questions were randomized and pooled. For this study, all assignments were due three or four days prior to the applicable exam. Students then had an opportunity to review the answers before the quiz and exam. Homework assignments included chapter questions and some of the Dynamic Study Modules, a new feature for fall 2014. Macauley changed this implementation for fall 2015: he planned to assign individual due dates for each MasteringA&P homework. He observed that when multiple assignments were due on the same date, students tended to procrastinate. The new due dates are designed to force students to stay on schedule and engage with course content on a regular basis.

Lecture quizzes. One MasteringA&P quiz was administered for each exam during the semester. Quizzes typically were due two days before the corresponding exam, and provided a benchmark score to help students prepare for exams. Students were allowed one attempt, but the quizzes were not timed. Results were available once the quiz closed.

MasteringA&P Practice Anatomy Lab (PAL) assignments. Two MasteringA&P PAL quizzes were due before the two lab practical exams. The goal of these assignments was to prepare students for the lab exams.

Take-home exam. Administered in MasteringA&P, this exam included any additional content that Macauley was unable to cover in lecture. Material included basic concepts presented in a straightforward way so students could learn it on their

own. The take-home exam was open book, open resource, and untimed.

Lecture exams. Five paper-and-pencil lecture exams evaluated student understanding of lecture material. Question formats included multiple-choice, fill in the blank, matching, true/false, case studies, diagrams, and short answer/essay.

Final exam. Content on the paper-and-pencil final exam was 25 percent cumulative. The remainder of questions covered content delivered after the last lecture exam.

Madison assessment test. Students were required to complete this test in the school's Testing Center within the first two weeks of class. It is a standardized science literacy and reasoning test. Its results are being analyzed and studied by Muskegon.

Assessments

Lecture

375 points	Lecture exams (five)
100 points	Final exam
60 points	MasteringA&P quizzes (six)
50 points	Take-home exam
50 points	Research paper
35 points	MasteringA&P homework
5 points	MyReadinessTest diagnostic quiz

Lab

200 points	Lab practical exams
50 points	Lab quizzes
50 points	Prelab assignments (due before each lab, a combination of paper assignments from the lab manual and MasteringA&P assignments)
20 points	MasteringA&P PAL assignments

Results and Data

Because Macauley was interested in investigating the relationship between student performance on the MyReadinessTest diagnostic test and course performance, an analysis of data collected during the fall 2014 and winter 2015 semesters was conducted (Table 1).

To understand if MyReadinessTest could identify at-risk students, diagnostic test scores were used to group students and assess exam performance. All students who completed the course were included in the analysis. If they did not take the diagnostic test, the score used in the analysis was a zero.

Semester	MyReadinessTest Average	MasteringA&P Average	Exam Average	Enrollment	# Students Not Taking MyReadinessTest
Fall 2014	50%	70%	75%	38	4
Winter 2015	46%	71%	71%	107	12

Table 1. MyReadinessTest Diagnostic Test and Course Performance, Fall 2014–Winter 2015 (N = 145)

Final Course Grade	% of Total Enrollment	% Not Taking MyReadinessTest	% Scoring Less Than 50% on MyReadinessTest	% Scoring 50–69% on MyReadinessTest	% Scoring 70% or Higher on MyReadinessTest
A, B, or C	79%	8%	40%	42%	10%
D or E	21%	22%	48%	30%	0%

Table 2. MyReadinessTest Diagnostic Test Performance per Final Course Grades, Winter 2015 (n = 107)

The mean MyReadinessTest score was 46 percent in fall 2014 and 50 percent in winter 2015. For the analysis, students were split into two groups: those who scored below 50 percent on the MyReadinessTest diagnostic test and those who scored 50 percent and higher, since 50 percent was the midpoint range for the MyReadinessTest assignment. The same analysis was conducted for fall 2014 grouping students based on a cutoff of 50 percent on the MyReadinessTest diagnostic score (Figure 1). An analysis grouping students at the fall 2014 mean of 46 percent resulted in the same findings but are not shown here.

Students scoring 50 percent or higher on the MyReadinessTest diagnostic test had a statistically significantly higher exam average than students who scored below 50 percent (Figure 1).

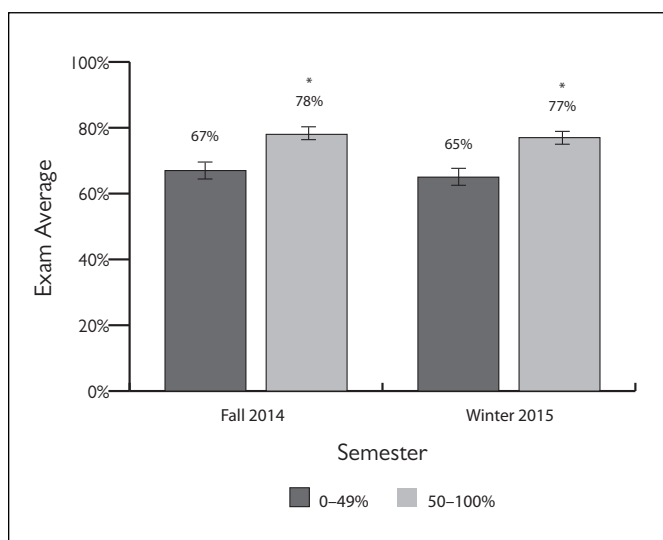


Figure 1. Exam Averages Based on MyReadinessTest Diagnostic Scores, Fall 2014–Winter 2015 (Fall 2014: 0–49%, n = 12; 50–100%, n = 26; Winter 2015: 0–49%, n = 51; 50–100%, n = 56) Err Bars = Stand Err; *p < 0.05

- In fall 2014, students who scored below 50 percent on the MyReadinessTest diagnostic test (M = 67%; SD = 10%; N = 12) had a statistically significantly lower score on exams than did students who scored 50 percent or higher (M = 78%; SD = 12%; N = 26) with $p < 0.01$ using a one-tailed t -test assuming equal variance. Approximately 32 percent of students scored below 50 percent on the MyReadinessTest diagnostic test.
- In winter 2015, students who scored below 50 percent on the MyReadinessTest diagnostic test (M = 65%; SD = 19%; N = 51) had a statistically significantly lower score on the exams than students who scored 50 percent or higher (M = 77%; SD = 16%; N = 56) with $p < 0.001$ using a one-tailed t -test assuming equal variance. The number of students in the two groups was almost evenly split: 48 percent of students scored below 50 percent.

Student performance on the winter 2015 MyReadinessTest diagnostic test was further evaluated based on final course grades (Table 2). Winter 2015 was used because of its higher enrollment compared to fall 2014.

Data shows that a majority of students who earned an A, B, or C in the course scored higher than 50 percent on the MyReadinessTest diagnostic test compared to students who earned a D or E in the course. However, Macauley found that students who scored below 50 percent did not all earn a D or E in the course. For example, the three students who earned As in the course and had MyReadinessTest diagnostic scores below 50 percent earned an average score of 81 percent on their MasteringA&P homework. On the contrary, the five students who earned an E in the course and had MyReadinessTest diagnostic scores below 50 percent, had an average MasteringA&P homework score of 24 percent. More analysis would need to be done to better understand and further test these preliminary

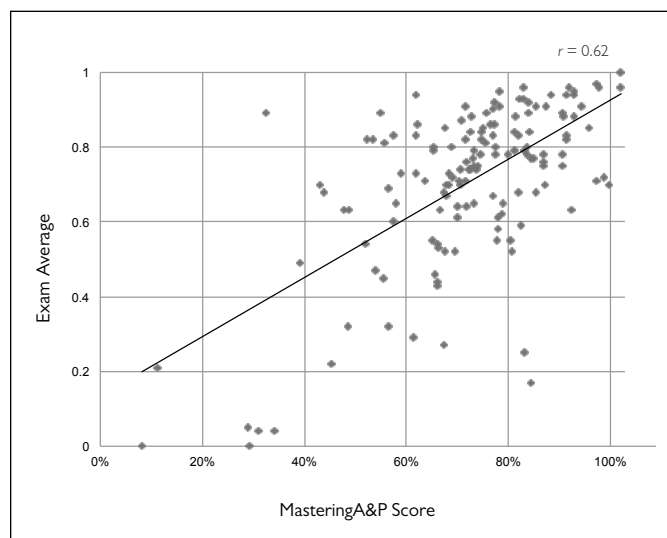


Figure 2. Correlation between MasteringA&P Scores and Exam Averages, A&P I, Fall 2014–Spring 2015 ($n = 145$)

findings, but the MyReadinessTest diagnostic score can provide information at the start of the semester for both students and instructors about student readiness. As a result, each can make decisions about how to proceed. Based on the finding that students who do poorly on the MyReadinessTest diagnostic test may also do poorly in the course, instructors can use the diagnostic test scores as an indicator as to who may be at risk and may need additional remediation to succeed.

To start to investigate the relationship between performance in MasteringA&P and exams, a correlation was calculated for all students in the study. Figure 2 shows that there was a strong positive correlation between MasteringA&P homework scores and exam averages, with $r = 0.62$.

The study's findings do not account for the unmeasured influence of variables that can impact student performance, such as motivation. However, based on the initial analysis of Macauley's results, the data from students in this study indicated that student exam performance and course grades were lower for students who scored lower on the MyReadinessTest diagnostic assignment and that a strong positive correlation existed between MasteringA&P scores and exam scores. Further research is needed to test these initial findings.

The Student Experience

In winter 2015, students were asked to answer an end-of-semester survey. Forty-two students out of 107 (39 percent) participated. In response to the question, How did using MasteringA&P impact your learning in the course? participating student responses included the following:

"It was additional study information at my fingertips when I was on the go and without my textbook."

"The PAL 3.0 was awesome! Being able to have models of fetal pigs at the click of a button was very beneficial."

"MasteringA&P really did help me because if I didn't get it the first time, doing it repeatedly reinforced something for me."

"MasteringA&P helped [me] recognize what the important concepts are that I should pay close attention to in my learning. I also learned a lot from the PAL 3.0 from the highlighted model parts."

Conclusion

"Gross Davis suggested an initial exam during the first three to four weeks of a course provides a good opportunity to assess students' level of understanding of course materials and possibly identify at-risk students. Actually, an initial exam or other graded assignment may serve a two-fold purpose to (a) identify the skills and deficiencies of students early on, and (b) convey instructors' academic expectations to students."² Because the MyReadinessTest diagnostic test provided an assessment of the concepts students need to understand to enhance their chance for success in A&P I, Macauley found that this diagnostic assignment at the beginning of the semester provided additional information about incoming students during this study. Macauley believes by being more informed about student performance using MasteringA&P and MyReadinessTest scores, he can better identify learning deficits, either coming into the course or as the semester progresses, and use that information to make decisions to enhance student learning with the goal of increasing student success.

The department and institution are currently analyzing the results of the study and evaluating options for possibly conducting a placement test as a requirement for A&P I in the future.

²<https://www.psychologicalscience.org/index.php/publications/observer/2009/december-09/helping-failing-students-2.html>

Implementation and results case studies share actual implementation practices and evaluate possible relationships between program implementation and student performance. The findings are not meant to imply causality or generalizability within or beyond these instances. Rather, they can begin to provide informed considerations for implementation and adaptation decisions in other user contexts. For this case study, mixed-methods designs were applied, and the data collected included qualitative data from interviews, quantitative program usage analytics, and performance data. Open-ended interviews were used to guide data collection.