DOMAIN 4: Educational Research / Scholarship	
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1. Overview: Briefly, summarize your educational research and/or your overall themes or goals. If possible, put your research in context with the larger field(s) you work in – e.g. what questions or problems are you seeking to address?	
My work focuses on trying to increase engagement and learning in large lecture introductory courses (over 60 students). This has involved studies on the use of classroom response systems, online quizzing, lecture capture, and flipped classrooms. I will focus on my most recent work on on-line quizzing.	
2. Identify a research activity you've chosen to focus on: e.g. a publication (*enter citation*), funded grant (*enter grant info*), presentation (*title, venue, etc.*), etc.	
Suchman, E.L. (2015) The Use of On-Line Pre-Lab Assessments Compared with Written Pre-Lab Assignments Requiring Experimental Result Prediction Shows No Difference in Student Performance. Journal of Microbiology and Biology Education. 16(2) 266-268. D10.1128/97815558199O3OI:	
3. Your role: Describe your role(s) and specifically what you contributed.	
I was a co-PI with a variety of colleagues over the years, analyzing the effectiveness of pedagogical strategies on student learning, which led to an interest in developing on-line quizzing to help increase the frequency of student studying. Every two weeks students take a 20 point on-line concept quiz designed to make them use material to answer previously un-covered questions. Students get a randomized quiz each time and can take the quizzes up to 10 times. I also created similar on-line quizzes for my laboratory courses which required students to prepare for class, and quizzes must be completed before class begins. I created quizzes for 3 courses, virology, virology lab, and general microbiology (consisting of well over 3000 questions), field tested, and revised questions based on feedback. This work has been shared with the education community via presentations within and outside CSU, as well as via the noted publication.	
4. Goal: What research question or educational problem were you trying to address?	
I am trying to help foster evidenced based teaching, trying new teaching pedagogies, then testing if these do in fact lead to increased student learning, and lastly and most importantly sharing what I have learned both within my department, college and university, as well as outside the university both through publications and speaking at national and international education meetings. Many students are "crisis management" studiers, only studying at the last minute. In order to help students develop better study habits on-line quizzing was added to force students to study during non-exam weeks, as well as allow them to practice applying concepts to novel situations.	
5. Methods: Briefly describe the methods used to achieve these goals. What is unique about this research or your approach?	
I began this work with the online quizzing in my virology laboratory course, where I replaced handwritten pre-labs with online pre-lab quizzes. When I compared examination scores between multiple sections of the course that either had wrote their pre-labs or completed the pre-labs online, I saw no reduction in scores, indicating this was a reliable way of replacing the very time consuming pre-lab grading. This led me to be interested in using online quizzing in my lecture courses to determine if they could be used to replace graded homeworks. In order to bring all sections of MIP300 general microbiology into alignment, myself and the other instructors began working together studying new pedagogies we agreed to try in our teaching. In order to compare courses we agreed on material to be taught in the course as well as examination content and co-wrote exams. All sections take a pretest which is compared to the same questions which show up on their final. When a new pedagogical approach is agreed upon it is tested in one section of the course and normalized gains are analyzed between sections to see if change in pedagogy leads to increased normalized gains.	
6. Scholarly approach: Describe your preparation and how your research plan was developed.	
We collaborate with a faculty member in the Education program and a statistician, as well as participating in the Center For Analytics Learning Technology group which collaborates to analyze data around student learning. We meet with our collaborators regularly, we implement an agreed upon use of the	

online quizzes between sections, and collect the data, our collaborators help us develop the study set up, and perform the statistical analysis to determine if we are seeing significant changes in normalized gains.
7. Results and impact: What has been the impact of this research – e.g. if applicable, has this research been used by others to improve teaching and/or learning? Has it been cited or otherwise built upon by other educational researchers? If used or built upon, by whom?
This work has led us to seek out collaborators in the school of education, who became particularly interested in our work on on-line quizzing. This collaboration led to our participation in the Center for Analytics Learning Technology and led our research in new directions. My current work on online quizzing has resulted in only one paper that has not yet been cited. However, this work has resulted in multiple presentations both within and outside of CSU, and almost all of the required microbiology courses in our major now use online quizzing to increase student engagement with material.
8. Reflective critique: Describe your reflections, what went well and plans for improvement. How has this research activity affected your own educational approaches, educational philosophy, or other practices?
We have learned that it is often very difficult to show that normalized gains are statistically significant, although we see slight increases in gains, they are often not statistically significant, which is exacerbated by studying sections that meet at different times of day, and or have different instructors. Overcoming these obstacles has been the main focus of our work over the last few years. This work has led to an interest in learning analytics that can be used on web based course activities and potentially used as predictive measures of student learning and outcomes. By working more collaboratively with the other instructors, and comparing my student's data to those in other sections, I was forced to analyze carefully the effects of pedagogical decisions. When we began this work the sections were not well aligned, and now are very well aligned, and many improvements were made in each course in response
9. Other products: If applicable, identify any non-traditional products (*peer reviewed or otherwise*) that have resulted from this activity (*e.g. a handout on evidence-based best practices in the use of student response systems that is widely used by other instructors in your college*).
This work has resulted in the inculsion of many of our concept based questions in a recent ASM book. Suchman, E.L, R. Knodle & Suchman, E.L, McLean, J (2016) ASM Sample Questions In Microbiology. ASM publishing Washington DC, Print ISBN : 9781555819903, D10.1128/9781555819903OI:

Commented [SAH1]: Scholarly approach: Were there any key publications or a body of literature that was particularly influential or informative?