

MICHIGAN STATE UNIVERSITY

16 March 2020

Re: Natalie **VANDE POL** Teaching-as-Research Mentor evaluation

Dear Michigan State University Natural Sciences Certificate in College Teaching Program:

It was a pleasure to work with **Ms. Natalie VandePol** for her CCTP mentored teaching-as-research (TAR) project. Ms. VandePol worked with me to design an active learning activity to support student success in my major undergraduate teaching assignment, MMG 425: Microbial Ecology. First, a bit of history about the course, my background, the course and my aspirations for it.

The course. MMG 425 is an elective for Microbiology and Molecular Genetics majors, a requirement for the MMG majors taking the Environmental Microbiology track, and a requirement for Biosystems Engineering majors. It is also taken by other majors, including crop and soil sciences, geosciences, environmental engineering, food safety and toxicology, and environmental sciences. It routinely enrolls between 50-65 students, and meets Tuesday and Thursday for 90 minutes. Most of the undergraduates in MMG 425 are juniors or seniors, though there is an occasional sophomore, and the break down is ~60-75% MMG majors with ~20-30% engineering majors and ~5-15% other. It is also often taken by first-year graduate students. Most of these graduate students are MS, but also some are PhD track.



Notably, there are no prerequisites for MMG 425 due to the broad and interdisciplinary representation of the enrolled students. This simultaneously offers a challenge and potential for learning enrichment because the students arrive with sometimes very different disciplinary knowledge and cultures.

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My background and aspirations for MMG 425. I am passionate about scientific teaching and I hold a certificate in scientific teaching from the Delta program at the University of Wisconsin Madison, which is a member of the CIRTl network. I informally employ teaching-as-research in my classroom, and include front-end, formative, and summative assessments to evaluate student learning. I take an iterative approach to developing content and learning activities, striving to continually improve with every offering. Because of my intellectual interest in scientific teaching, I am delighted to mentor and support teaching-as-research projects, and it was simply fantastic to work with Ms. VandePol on her project.

As a tenure-track assistant professor, I have been teaching MMG 425 since 2016. In my first year, I noted that the content was out-dated and I wished to re-envision the course with updated content. I also aimed to develop the course to exclusively employ the active learning techniques that I had learned during my training with the Delta program. In my first year of teaching, I developed team-oriented active learning content with a flipped classroom. The students were to read curated content (papers, reviews) that I assigned in

advance of the class, and then come to class prepared for a brief discussion of that content with powerpoint slides and to address and questions. For the remainder of the class time, I developed team-based active learning activities that were centered around mutual problem solving based on the concepts that the students were to have read in preparation for the class. *It was an epic fail.* I learned that most of the students had never been exposed to active learning prior to MMG 425, and had an expectation that lectures were the “best” way of teaching, and so they were hostile to the “new” approach. They also did not prepare in advance of the class- many of them did not complete the assigned reading. I realized that the students were not at the level that I expected for reading comprehension and writing. Major adjustments were necessary. Thus, for the second time that I taught MMG 425, I focused just on delivering the content as the students expected: I prepared and delivered all lecture-based learning materials. While I personally found this unsatisfying, it allowed me to gain trust of the students and reset the content completely. Then, in my next year, I started to gradually “flip” a few lectures, in that I would provide a traditional lecture first and then next provide a team-based active learning activity in class to reinforce the concepts. I used exam data to identify the concepts that students struggled most with, and prioritized those for developing the new team activities. This is exactly where Natalie’s TAR project came in!

My long-term goal for MMG 425 is to have a completely flipped classroom, where lecture content is available online for pre-classroom consumption (recorded lectures with powerpoint slides), and the class time is completely dedicated to discussion and team-based, active-learning to reinforce the lecture concepts, with an emphasis on work that fosters development of transferrable skills like problem-solving and teamwork. Slowly, I am prioritizing lectures for flipping and hope to flip at least one per year until they are all finished.

Natalie’s TAR project. Natalie used exam data from the prior year to identify questions and their associated microbial ecology concepts with which students, on average, particularly struggled. Based on prior exam performance data, Natalie discovered that students particularly struggled with biogeography concepts and the ideas that the environment selects for the best-adapted populations from a pool of dispersed cells. She originally proposed a board game to support student learning of these concepts, but after discussion we agreed that there would not be time for students to complete a traditional board game. She instead had them work through a game that was guided by a worksheet and allowed teams to interact with each other at key parts. The game that Natalie invented dovetailed really nicely with an existing team learning activity built to reinforce concepts about microbial biodiversity. Briefly, the biodiversity activity used craft “pompom” communities from a Martian rock to have teams apply and calculate richness, composition, and understand rarity and dominance. Natalie advanced forward from that biodiversity activity and utilized the same Martian rock pompoms to create her novel biogeography game. This provided students with some familiarity with the materials to bridge their reception to a different activity. For the game, Natalie designed environmental gradients and assigned species fitness to pompom populations, using key conditions that, in real life, drive microbial distributions like pH and carbon availability. It is a very rich activity, incorporating not just biogeography and deterministic selection, but also dispersal, heterotrophy, and structure/rarity. The guided discussion, advanced by Natalie’s follow-up questions after the game, has also proved to be very effective in

helping students to reflect on their engagement with the game and how it extends from the lecture content.

Natalie has executed her biogeography game now twice in MMG 425 (SS19 and FS19), with minor tweaks in between. We also used sticky note impressions and iClicker surveys at the end of the game and prior to the next lecture to collect useful student feedback. The data show that the game was generally effective at supporting student learning. Also, the students really enjoyed it! I think that Natalie's approach was data-informed and appropriate for her TAR question. We have discussed her results and I agree with the findings, noting the nuances across different types of exam questions (essay v. multiple choice, multi-topic) and how working on generally transferrable skills like writing and logic is also likely support students in responding essay questions about biogeography. **I think that Natalie's approach was creative, innovative, and the data show that it positively engaged the students.**

I will continue to use Natalie's biogeography game in MMG 425, and Natalie and I have already discussed how it could be extended and enriched even further to branch out to more fully include concepts in dormancy, rarity, and heterotrophic strategy. We've also discussed how Natalie's activity could be modified to use to engage at public outreach events, which is an added bonus.

As an evaluation of Natalie's performance, it was **excellent**. We had a brief rough start with communicating classroom needs in the beginning, but that equally attributable to my inexperience in mentoring a TAR project and myself learning the type of communication needed to help graduate students get quickly up to speed on course content that they have never engaged with personally. Natalie was passionate about her activity and put a lot of time into it, and we went through several iterations for the first round and made informed revisions to the second round. She also did a lot of background reading of the literature to get up to speed with the state of the field in this research area. She was reliable and consistent, professional and went above and beyond to spend time in the classroom getting to know the students prior to her learning activity, and also afterwards for the final class presentations. I think that this made the students feel good about providing feedback and demonstrated that she cared about them and that she was working towards their best outcomes. I also perceive that she balanced her TAR project well with her research commitments.

This was my first experience in mentoring a TAR graduate student project, and it was a highly rewarding experience. I hope to have the opportunity to work with future CCTP students. I wish Natalie all the best in her future teaching pursuits and I am happy to provide additional information if needed.

Sincerely,
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