

Engaging students in developing course improvements leads to both faculty and student insights

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Abstract- Sometimes we learn new approaches to teaching from the occasional conversation with colleagues, an article in a journal or attending a conference. In this article, I describe engaging students in reflecting on a past class, then suggesting new approaches to teaching that they feel would improve the class. I gathered this insight as part of a class titled “Teaching of Biology”, BIOL 400 at Penn State Harrisburg, which had 17 upper-level students registered in Spring 2020. For the initial several weeks, we discussed as a class student-centered approaches to teaching including using case studies, peer review of writing, and interactive questions during class. Students picked one past class that they particularly enjoyed and interviewed the faculty member to ask about how they prepared for the class and about their strategies for supporting students’ learning. The students shared the creative strategies with the whole group and later, the new approaches they suggested based on their collective learning in this course. As part of this process, the students gained a much better perspective of their faculty as people, as researchers, and as someone who really cares about their students and their teaching. I learned much more about the creative approaches my colleagues were using, specifically ones that the students felt were helpful. The strategy I used would likely provide insights for others in their desire to improve their teaching of engineering and science classes.

Description of the class and results- I gathered this insight as part of a class titled “Teaching of Biology”, BIOL 400 at Penn State Harrisburg, which was initially designed for those students supporting our chemistry labs as teaching assistants. I opened the class to anyone interested in the topic and had 17 upper-level students registered in Spring 2020. For the initial several weeks, we discussed student-centered-approaches to teaching as a class including using case studies, peer review of writing, and interactive questions during class. Students picked one past class that they particularly enjoyed and interviewed the faculty member to ask about how they prepared for the class and about their strategies for supporting students’ learning.

The students shared the different approaches used in their chosen class in short presentations about halfway through the class along with a paper summarizing the information and the interview with the faculty. Many of the topics the students noted as positive attributes of the class included engagement during class, visuals that made the concepts easier and different strategies for making the concepts relatable to real-life. Below is a table summarizing many of their ideas and attributes.

Table 1- Summary of courses and positive aspects noted by students

Course field (# different courses)	Course ideas used or positive attributes remembered – paraphrased from student submissions (selected)
Biology (6)- 2 students picked the same class	<ul style="list-style-type: none"> • Had a game for teaching about Mendelian inheritance • Used case studies to connect real-life situations to concepts discussed in class • Had a memorable assignment of an essay where students had to research how important water is • Had weekly quizzes covering reading and previous lecture • Used mentor/mentee groups in class to support inexperienced students using more experienced students
Chemistry (5)- 2 students picked the same class	<ul style="list-style-type: none"> • Used lots of visual approaches to learn core concepts • Had students present on a molecule-of-interest to the class for extra points • Used popsicle sticks to pick students to call on during lecture for participation points • Made learning relevant to students' lives • Used a "How-To" for each section of the lab report to help with writing
Social Sciences (2)	<ul style="list-style-type: none"> • Had a lot of group work applying what we learned to real life situations • Invited guest speakers which made for an interesting class where they talked about their projects • Integrated games and technology like Kahoots to help us learn the material • Allowed students to revise work if they received no points • Applied course material to other situations which contributed to a higher level of learning
Math- Statistics (1)	<ul style="list-style-type: none"> • Used quizzes based off the homework to encourage doing this work • Recommended students bring the textbook to class to follow along during lecture • Gave credit for correct work or process even if the final answer wasn't correct • Allowed students to bring a formula sheet to exam
Humanities- Ancient to Medieval Art (1)	<ul style="list-style-type: none"> • Created a "fake dig" we had to use to unearth objects like at a real excavation for an archeology class • Used great visualizations and hands-on projects • Provided a study guide before exams that had example questions • Reviewed information from the book to explain interpretation of the material

For the latter half of the class, students were then to consider the approaches to classroom engagement we had discussed in the first part of the class or they learned from their class peers and propose ways to incorporate those innovations into the class they had chosen. They were then to share this with the faculty member as a follow up. This class was being conducted in Spring 2020 and so some of the formal interviews and follow-up with the faculty members did not occur. The students submitted a final paper and did class presentations on their suggestions for the additions to the class of their focus. Some of the course improvements students suggested came from them applying experiences from different classes, discussions in this class, or an example given by another student in this class. The improvements suggested by the students included:

- Use case studies (some specific ones suggested)
- Use Jigsaw cooperative learning method
- Add pre-class discussion questions or pop-quizzes after lecture
- Create videos showing lab protocols or safety, using specific instruments, solving problems or explaining specific tough topics
- Have students find new labs to conduct
- Use simulations for lab or modeling concepts before class
- Assign a bacterium to each student to follow through the semester*
- Have students reshape curriculum toward their career interests

*This was similar to an approach I used in a Cancer Biology class the same student was taking where students each picked a type of cancer at the beginning and followed it throughout the course.

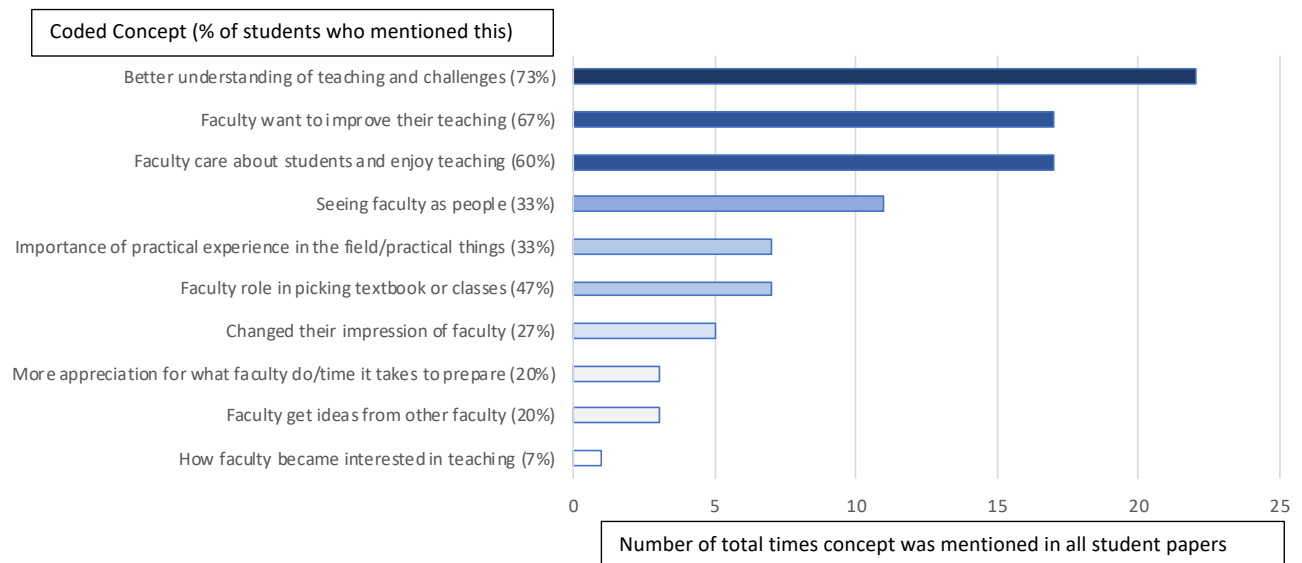
Insights from this class experience- All in all, both I and the students learned a lot from the experience. As you can imagine, the students gained a whole different perspective on faculty members and the work we do and the challenges we face. Here are some of the quotes from the students' final papers reflecting on their experiences and observations from the interviews.

- I learned that a lot of prep comes with being able to present at least a decent course. All of this is really making me understand how difficult it is for professors to make sure they are teaching everything they can, with as much detail, in the short time that they have, but also without rushing through everything and maintaining a “healthy” pace for the course.
- I had never thought that a teacher would go out of her way to find a better textbook, especially when they are in a situation where they can just use one everyone else is using and not worry about the textbook.
- I also learned that not everything goes as planned, these factors can change the class structure and make one modify the schedule as the semester goes; even though one can teach a course, this does not mean there is no more learning to be done.
- [I] learned that there is a lot more that goes into creating and keeping up with a course.
- [I] did not realize that teachers also have a learning curve as they must learn how to be good teachers for each class because in one class, they may be well-loved and successful but, in another class, they may be disliked, and their students may not understand the core concepts under their teaching.
- I learned that professors are also affected by our responses and how we learn. If we show interest and are willing to learn, professors will want to teach.

- I also learned that professors get anxious before teaching a class... I would interview [faculty name] 1,000 times again if I could, because it was such a great experience.
- [The faculty] not only is a great professor but a great person. We sometimes forget that our professors are people and that they can make mistakes. She showed her humanity and professionalism all at once.
- Dr. [xxxx] thoroughly enjoys teaching and strives to help students connect things in the classroom to real life; [this] was extremely enlightening.
- I concluded that [the faculty member] cares about her students.

The students gained a perspective of their faculty that was very different from what they may have had in the past. There were many common concepts mentioned by the students in their final paper describing the full experience they had. These are represented in Figure 1. The majority of the 16 students mentioned gaining a better understanding of the teaching and its challenges. This experience might provide students with more empathy for the hours spent grading and creating materials for class by the faculty member. Seeing faculty as people may support this as well. The realization that faculty generally want to improve their teaching was also mentioned by a majority of the students as well as that faculty care about students. One student was specifically impressed by learning how a faculty member became interested in teaching. The student had already a sense this might be a career they could explore; this insight supported their further exploration of that opportunity in the future.

Figure 1. Concepts mentioned in final student papers



How might these insights support students' learning in other ways? Several students mentioned that faculty are constantly learning in their discipline and about different teaching techniques. This models life-long learning for our students that could have a major impact for their future. The agency given to the students to pick a specific class to focus on, create the questions for the faculty and the creative license to suggest approaches that could improve the chosen class embodied a respect for our students and the value they have in the learning environment. I

believe this approach to create a collaborative learning experience for both faculty and students afforded a special environment that could be replicated in other situations.

Also, in this process, I learned much more about creative approaches my colleagues were using. I found it a very rewarding experience that others could consider emulating. Yes, if I'd known to ask my colleagues in chemistry, psychology or math about what they did in class, I certainly would have learned many of the creative strategies they included in the class and the students valued. Sometimes there is an opportunity to share best teaching practices on a campus during public events. Though in reality, I might have focused my attention on those faculty teaching courses similar to those I had taught or planned to teach in the future, or in my area of biology and not in others. By engaging my students to be the conduit for this information, I was able to learn from a much wider source than those I normally consider as the students are taking courses in the vast areas of academia, not us. Also, I learned what the students themselves thought was useful (not the faculty member). And in that sense, the students' perspectives are uniquely valuable, and I posit not as often culled for our collective benefit. I therefore suggest we consider other ways to do this more. Our students have special insights for us if we ask them.

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