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ACUE Reflection from a STEM Perspective

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Motivating Students Using DAPPS

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DAPPS stands for Dated Achievable Personal Positive Specific goals. This technique was new to me, but I immediately wanted to adopt it for teaching students how to write effective laboratory reports. Oftentimes, students start chemistry courses with little to no understanding on how to write reports. DAPPS allows them to set small goals to slowly understand the various parts of a report until they meet their end goal of a final comprehensive report. The biggest problem I encountered was students misunderstanding sections of their reports. However, we overcame this by working together more. I also constructed an FAQ page for them to reference to assist them in their writing. The vast majority of students were able to properly segment their findings appropriately and explain their conclusions thoroughly.

Planning an Effective Class Session

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The “I do, we do, you do” method of helping students learn was adapted for a general chemistry discussion class where students come to learn material not covered in lecture and/or answer questions students have on material. I have had students work together before, but not in this style. Students often learn well from one another. Chemistry is not an easy subject, and this allowed them to learn from me and from their peers. I believe it also helped them gain the courage to work independently after learning techniques that help others. Some students were hesitant to work with a neighbor they did not know. Many are still freshman and not used to alternative classroom settings, so being told they are not only allowed, but are encouraged to speak was a change for them. After helping facilitate discussion, I noticed more students speaking out to answer questions I asked. They also seemed encouraged to work independently on their remaining homework assignments. To refine this, I will try to guide the we do/you do portions better to help students stay on task and not be afraid to compare their work with one another. I will also use start of class work to engage them early.

Delivering an Effective Lecture

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I chose to incorporate strategic pauses into my lecture. In the past I have had a bad habit of answering my own questions without giving students an opportunity. Sometimes the students are too nervous to answer questions unless they are given enough time to check their answers. I tried to mentally count to 10 to allow ample time for students to be confident in their answers. I noticed a large increase in student participation and willingness to attempt to answer questions. I noticed more of the quiet students speaking up to answer questions I asked. We had only met a limited number of times, but I was able to pick up on who the more chatty and quiet students were. It was encouraging to see the quiet ones be more actively engaged. On the other hand, there was a lot of awkward silence. I am not sure if this is from the students still working on the answer or just not knowing what to say. I am going to add social media to the pauses to allow students to anonymously submit answers online. This will allow the shy students to try answering while still remaining comfortable in their setting.

Using Concept Maps and Other Visualization Tools

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I have not tried using flowcharts for chemistry laboratory lectures before. I chose to do a flowchart as it would break down the steps for the lab into smaller portions in hopes of making things easier on the students. I noticed with the flowchart, more students made mistakes than without. I'm wondering if this is because they were too busy reading the chart instead of listening to my lecture. I noticed more confusion around the students. Normally I draw the technique on the board, but this time, using words instead of drawings did not work for my students. However, I did notice more communication among the students as they were helping each other out more. Next time I will use drawings along with the steps of the flowchart so students can visualize the experiment as well as read along with what they are supposed to do. I may also have the students perform the experiment alongside my lecture to ensure they are truly comprehending what they are told.

Using Concept Maps and Other Visualization Tools

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I chose to use clicker questions to survey students during lecture. Chemistry is a difficult subject for students to understand. Clickers let me gauge student understanding in real-time. The students also answer anonymously so those that are uncomfortable asking questions have an opportunity to get help. The students really liked using clickers. It was helpful for me to see if any students were struggling with the material. I was able to back up and re-explain some concepts that I would not have known students were struggling with otherwise. Clickers let them work independently towards an answer, and the students were also encouraged to speak with a neighbor to compare answers and the reasoning they were using. The largest challenge was getting full participation. On some questions, 17 answered, while on others 35 answered. I will couple clickers with think-pair-share more to allow students to work together and submit 1 answer as a group. This would help with increasing participation as well since there will be another student present and each group will have to submit something.

Planning Effective Class Discussions

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I gave my students three questions to answer before we began lecture. The questions were:

1. What types of everyday activities do people use the scientific method for?
2. Where do we see density in play in everyday life?
3. Why can people get tired or fatigued when they don't eat?

I chose this technique because chemistry students often need help understanding where chemistry applies to their professions and everyday life. I want them to be able to apply some of the lessons from class to their lives. Creating my questions made me think about how students feel learning the class material. I loved it as a student, but it was my major. My students now are not chemists. While they have some interest in the material, they aren't necessarily excited about it. The questions made me take a step back and think about how to get them excited about the material. I firmly believe these questions will help the students see that chemistry is all around them, and they use it every day without even knowing. I also want to relate class to their general health by relating the energy from nutrition lesson to them personally. I plan to use the open questions in graded online discussion forums. Question 3 will be presented during lecture as a think-pair-share.

Facilitating Engaging Class Discussions

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I chose to use wait time to encourage the quieter students to answer questions. It's oftentimes difficult to know if all the students are understanding the subject matter in STEM fields. The classes are also quite fast-paced, so if students do not speak up, I assume they understand everything and move on. Adding wait time gives them a chance to process the information and muster courage to speak up. I certainly noticed more students in the back of the classroom speaking up and asking questions. Even though my more dominant speakers answered questions quickly, I remained quiet to allow others to agree, disagree, or ask for clarification. Quieter students spoke up much more, and I noticed the dominant students also sitting back and allowing others to participate first before answering questions. I plan to use this more with learning checks and when facilitating feedback from the students on whether or not they fully understand the material. I also plan to use this to encourage students to reply to each other to help the class learn from their peers.

Using Advanced Questioning Techniques

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I chose the CLOSE-UP technique to encourage students to think critically and relate current content to past content. Specifically, I wanted them to be able to answer why chemical compounds are named certain ways, not just how. I noticed my students were much quieter during times in which I asked them to link or provide evidence on chemical compound naming. After a brief silence, a student would eventually speak up and answer. I was nervous that the students were not comprehending the subject, but now it seems they were thinking about the subject and reflecting on my questions. Students who normally are quiet were speaking up and answering my CLOSE-UP questions. They seemed eager to answer questions that provided a deeper level of thinking, which is a bit out of the box for chemistry students. I want to try to use other parts of CLOSE-UP like open-ended and synthesis. I am sure with some more planning, I can develop strong questions to enhance students' understanding.

Checking for Student Understanding

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Often I ask my students if they are understanding content, but I really can't tell unless they answer a question related to the material. In the past, I have used online clickers, but I noticed participation decrease over time unless I award points. Here, I purchased individual whiteboards and markers for each student, so they can all attempt to answer questions and show me their answers. I can then gauge how everyone is doing without embarrassing students that may be confused. The students really seem to enjoy the whiteboards as they can adjust their answers if incorrect the first time. There is also less pressure to answer the same as their peers since they can only see their response. I have started to use both forms of polling. I use the online polling for days where I want to take roll or maybe even give extra credit, and the whiteboards for days where I just want to see if the class is understanding the content.

Using Student Achievement and Feedback to Improve Your Teaching

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I chose to use data to inform instruction because I want to learn how I can critically analyze student responses on exams to see the effectiveness of my instruction on student learning. I often try to visually determine weak points in my instruction, but I wanted a better method of pinpointing this. The data sheets we were given provide this. Learning outcome #3 requires more review and possibly an alternative method of instruction to facilitate student learning. Reviewing question 9 will help determine why only 32% of students answered correctly. Outcome #2 was also somewhat low in correct responses and should be reviewed. Outcome #1 overall had a high percentage of correct responses. Following up with students that may be struggling (looking at individual responses would provide more clarity) can help ensure overall class success. I gained much more insight on how I can analyze student understanding of material. I plan to utilize the data insight pages in my upcoming courses and then know what questions and learning objectives to review in more detail.

Connecting With Your Students

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I chose to do an online survey on my class Canvas page to get to know my students and connect with them. I first wanted my students to know I am invested in them succeeding and want to get to know them. Many students believe professors do not care about them, and I wanted to start the course off by showing that I do care. I also gave my own responses to the students so they could get to know me a bit more outside of the classroom. The students loved the survey. One also confided in me their preferred pronouns although they are not fully “out” yet and thanked me for doing so. I noticed right away that the students became more invested in the class as they realized I was invested in them. I also was able to know why they were taking the class and gauge individual motivations for success. I plan to expand the survey a bit more and ask future students about their learning style, concerns for the class, and their future goals.

Promoting a Civil Learning Environment

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I chose to use reminders, proximity, and name-dropping to address low-level interruptions. I have always struggled with how to address low-level interruptions. I have tried to talk over the students but often find myself getting distracted or frustrated at the situation. I found using this strategy worked in a couple different ways. The first was that although I am laid-back, I was able to show that I do not tolerate disrespect to me or their peers. Using this strategy also showed that I pay attention to the whole class and am not just focused on teaching. Students started asking me questions instead of each other while I was speaking. I also overheard someone tell their friend to wait until after class to tell her something not pertaining to lecture. I plan to also implement a section about incivility in my syllabus and state that I respect my students and expect that in return, I be respected by them.

Providing Clear Directions and Explanations

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Students are expected to figure out the purpose of a lab, but often do not come to the correct conclusions. By stating the purpose up front, they were able to write better lab reports and had a deeper understanding of the material. Students seemed much more engaged in my pre-lab lecture and were later actively discussing how it relates to their lecture class. They started understanding why chemistry classes are more than just lectures. Students were more motivated to write more elaborate reports and make connections with their lecture class. I plan to work more with the students to establish the purpose of the experiment together, rather than flat out telling them the answer. This way they also learn critical thinking and analysis skills.

Engaging Underprepared Students

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I chose to use early in-class, nongraded assignments to gauge the overall and individual readiness of my class. Basic algebra skills are needed to succeed in the class, and I want to make sure the students are confident in their abilities. The non-graded quiz allows the students to know what they need to brush up on and lets me see what I need to review with them. Overall, the students were able to get early feedback on their strengths and weaknesses for the course, which further helped them study for exams. I was able to gauge what I needed to slow down on and review with them. Students were relieved when I discussed the quiz outcomes and found that many struggled with the same concepts from algebra. I made sure to review the concepts and stress to the students that I and campus tutoring are available to help them if they require more 1-on-1 help. I plan to have a representative from the tutoring center come speak to my class to explain their availability. This also shows the students that the tutors are also students which may help ease the pressure of learning from a professor.

Helping Students Persist in Their Studies

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I chose to offer my students the choice of term project format. The project also was designed to make a connection between the course and their future careers. I do my best to stress how chemistry is important to careers in health and nutrition, but many times the students can't quite see it. I wanted them to do their own research, while also presenting it in a format they liked best. I gave them the choice of paper or presentation, as some prefer writing and others like public speaking. I had one student tell me the project helped her decide that she does want to pursue nursing. Others were happy to choose how to present their research. Only 5 chose to do an oral presentation, but they all expressed how relieved they were to have that option. Students described feeling more confident in their chosen careers and were sharing their findings with each other. I plan to continue using this project. In the future I will offer the chance to turn in a rough draft for early feedback so they can correct errors and get a better overall score.

Embracing Diversity in the Classroom

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I took a few of the Implicit Association tests to see what my bias is towards diversity so I could work to fix all biases I may have. I was relieved to see my results showed that I tend to not have any biases toward race or sexual orientation. I was a bit surprised to see the test results showed a slight bias towards intelligence and black people and a preference for LGBT over straight and white people. While I don't want any students to feel less important than others, I was relieved to know I don't hold race or orientation against anyone. The results helped me know that I acknowledge diversity and understand that diversity is important to embrace. Rug-sweeping and 'colorblindness' it only makes matters worse.

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Establishing Powerful Learning Outcomes

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My syllabus learning objectives looked and became stronger. Oftentimes the objectives look vague, but the revisions made much more sense for students to understand what they are expected to learn. The outcomes show the students what I expect them to be able to do, as well as shows them what I expect myself to guide them towards doing. The outcomes are now incorporated into the syllabus. I also state the outcome(s) that relate to each assignment. I plan to continue to revise my other outcomes so that they match the quality of my first revised ones. I also will input them into my modules for each lesson plan.

Aligning Assessments With Course Outcomes

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I chose to use an assessment blueprint to chart the scaffolding of my test questions. I have tried in the past to scaffold my exams but did so without a structure. Because of this the weighting of each outcome was skewed improperly. This let me first see this error and then correct it for future classes. I now see higher exam scores as students build upon ideas while answering exam questions. This also shows them how all the subjects learned relate to one another.

Aligning Activities and Assignments With Course Outcomes

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I chose to make an in-and-out of class time map. I wanted my assignments from outside class to be more than just busy work. I wanted to build on lecture and enhance learning. Using this planning method let me visualize how to do so. I was able to track student activities and observe how they complimented each other to enhance student success. I applied this to my entire course and assignments. I also made sharable planners so that students can see and understand why they have certain assignments.

Developing and Using Grading Guides, Checklists, and Rubrics

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I chose to create a video to explain rubric criteria. I have my chemistry students write or present a term project relating their chosen career to chemistry. I made a rubric, but it seemed as though there was a lot of confusion. Making a video gave them another resource to refer to in case of confusion. The video seemed to help quite a bit. I was able to expand upon what was specified in the rubric, so they had clearer information on what to do. I noticed less questions in class on the project as the video addressed most concerns. This also benefitted me as I didn't feel like a broken record repeating the same thing every class meeting. The students seemed to have a better understanding of what was required of their projects and almost all of them earned an A.

Preparing an Effective Syllabus

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I chose to use the checklist to see if my syllabus contained most of the recommended items. I closely examined my syllabus compared to the checklist and was extra critical of myself. If one portion of a multi-criteria checkpoint were missing, I highlighted it to address for my upcoming class. Overall, I was pleased with myself as I was only missing 7 of the 27 recommended syllabus criteria. However, these missing criteria were important to address as they included policies on classroom decorum and an ADA statement. Once my syllabus was fully revised, it clearly outlined my policies both inside and outside the classroom. I want my students to have a document that fully explains my expectations for them and for myself.

Developing Fair, Consistent and Transparent Grading Practices

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I chose to use a point system for course grades combined with standards based and norm-referencing. I want all of my students to do well, and I also know that sometimes my exams may be more difficult than the average student is prepared for, so I based a 100% on the second highest score. First, I added a breakdown of point and letter grade assignments in the syllabus so students can easily calculate their grades. I also implemented a system where the second highest exam scores will be counted as 100%. This allows me to award the highest achieving student while also accounting for students who understand the content but may have stumbled on the exam. I want my students to know that their individual performance is really what matters, but that I also use the overall class performance to gauge individual exam performance. The students also now have a clear breakdown of points, to the extent that some may figure out what assignments or projects they may not even have to do yet still be able to get an A. I now make sure all of my policies are described in detail in the syllabus and also make videos to post that detail everything as well.

Using Active Learning Techniques in Small Groups

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I chose to incorporate the Jigsaw method for naming organic compounds. The class broke into groups where each had a specific functional group-containing compound. They then all came together and taught the other groups how to name that functional group. Many even came up with techniques to remember naming conventions. I made sure to circle the room and check in with groups to ensure confusion was minimized. The students ended up remembering the material better and became more confident in organic chemistry nomenclature.

Developing Self-Directed Learners

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I used examples of term projects from past classes to show students good examples of what is expected of them. While many still waited until the last minute to submit their projects, they provided high quality papers that may not have been possible without examples.