A Vibrant, Interactive Classroom for Lifelong Student Success

Darren Strash
Visiting Assistant Professor
Department of Computer Science
Colgate University
dstrash@colgate.edu

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At heart, I am a showman. I am excited to teach, excited to see my students learn and succeed. My excitement invariably escapes and spills over to my students—which makes them more likely to think, participate, and desire to know more about a topic. But excitement is only a small part of a successful classroom: it cannot give students the knowledge and skills required for mastery of a subject, for achievement in the classroom, and for lifelong success. Therefore, in addition to excited and dynamic teaching, I strive to meet three objectives: I seek to *challenge and reach every student*, to instill in them *motivation and confidence*, and to impart fundamental skills that extend *beyond the classroom*.

Challenging and reaching every student. Each student has different strengths and weaknesses. During each lecture, I gauge understanding by asking questions often and by calling on every student at least once (when possible). This helps me understand how each *individual* student is progressing in the course. To evaluate overall comprehension, I consistently survey students to find blind spots in learning, and give weekly "check ins" that test for both basic and deep understanding of the current subject matter. For those students who are excelling, I offer challenging projects that complement the course material and I tailor these projects to their interests. For example, in *Introduction to Computing*, I worked one-on-one with two students who are avid video gamers, setting time aside each week to meet with those students and enhance the course material with game-oriented projects; I further offered challenging problem-solving based projects to a third student uninterested in game development. Likewise, in *Algorithms*, I have given graduate-level problems to students who excel in mathematics.

For those students who are having difficulty, I set up frequent meetings and offer encouragement and strategies for how to approach their coursework. I also take actions to lower barriers for these students to seek help. I facilitate and encourage peer-led study groups, and I personally invite students to my office hours to work through practice problems and reinforce the material. Several students have expressed how much they appreciate me reaching out, and admit that they would not have come to office hours otherwise. This method has been especially effective at reaching students from underrepresented groups, who I have found struggle to reach out.

To accommodate students with different learning styles, I use different kinds of media in the classroom, such as video, slides with colorful figures, and real-world objects when possible. In addition, for students whose primary language is not English, I communicate in creative, non-traditional ways during office hours: by speaking in different languages, drawing, using hand gestures, and even using translation software. These techniques were highly effective in reaching students during my

two years spent as a postdoc in Germany, where many students struggled with English.

Motivation and confidence. Mastery of a subject through consistent challenges contributes to student achievement, but it is not sufficient. To address sufficiency, I actively exercise students' critical thinking skills and creativity, and have them work in groups—which instills the motivation and confidence needed to persevere through the course. First, I give students a firm foundation on which to build confidence: I give clear and coherent methods for solving problems by systematically working through solutions, which almost always involves a deeper discussion of the *method* used, rather than just solving a problem in isolation. I illustrate relationships between problems and solutions using many examples, and give exercises that require non-obvious application of course material. With *methods* as the primary product of the lecture, students have confidence to tackle new problems, and stay motivated while solving a difficult problem that requires a creative solution.

This method has been successful in my *Analysis of Algorithms* course, where I introduce new techniques in lecture, then walk through one example solving a problem with the technique, and then have students solve new problems in a way reminiscent of a recitation or discussion course. I dedicate 10-20% of class time to having students solve new problems in breakout groups to give them confidence before they must solve problems on their own. This group work encourages participation from students who are normally shy, as they are more likely to share in a small group of peers with which they are comfortable. After several sessions, I rotate group leaders, giving those shy students the opportunity to lead and build further confidence. I further encourage individual participation in class by gamefying it—students collectively earn rewards if every student participates in class. I have found that once a student participates several times under such a challenge, they are more likely to participate in the future, even without an incentive.

Skills beyond the classroom. While critical thinking, creativity and group work help to instill confidence in students, these are also desirable lifelong skills that contribute to overall success. I have found that in-class group work encourages students to actively work with other students when not prompted. To further encourage collaboration, I offer students the opportunity to work together on homework assignments, and I design difficult problem sets so that students will naturally want to brainstorm together. I find that many students understand the material better when solving problems collaboratively, rather than just working in isolation.

I further exercise my students' writing skills, by requiring them to write solutions to problems on homework with mathematical formality. I further have students write a summary of content related to, but not covered in, the lectures. I provide extensive examples of mathematical writing, and emphasize precise yet succinct writing—a desirable skill that requires much practice.

Experience and Readiness

I have over three years of experience teaching introductory and algorithms courses at both the undergraduate and graduate levels. In my current position at Colgate University, have I taught two sections of *Introduction to Computing*, three sections of a 300-level *Analysis of Algorithms* course of my own design, and a 400-level *Advanced Algorithms* course of my own design. Prior to Colgate University, I developed a graduate-level seminar at Karlsruhe Institute of Technology entitled *Algorithms for Large Social Networks in Theory and Practice*, and I was the lead lecturer for a graduate-level course *Computational Geometry*. The feedback from my courses has been overwhelmingly positive: many students positively remark that my lectures are clear and precise, and that they have never received such detailed and helpful feedback from any other instructor before.

Given my current teaching experience, I am prepared to teach beginning to advanced algorithms and data structures (both theory and practice), algorithms for massive data, computational complexity, discrete mathematics, security, programming in C/C++, Java, or Python, software engineering, and operating systems courses. With some further preparation, I could also teach cryptography, AI, game development, distributed computing, and scientific computing.