Application Summary

Competition Details

Competition Title:	2020 CTL/BP Junior Faculty Teaching Excellence Award
Category:	Institutional Awards - CTL
Award Cycle:	2020
Submission Deadline:	03/02/2020 at 11:59 PM

Application Information

Submitted By:	Jacqueline Mohalley Snedeker
Appplication ID:	4320
Application Title:	AJ Medford
Date Submitted:	02/28/2020 at 3:49 PM

Personal Details

Applicant First Name:	AJ
Applicant Last Name:	Medford
Email Address:	ajm@gatech.edu
Phone Number:	(404) 385-5531

Primary School or Department
School of Chemical and Biomolecular Engineering

Primary Appointment Title:	Assistant Professor

Application Details

Proposal Title
AJ Medford

Professor David Sholl
John F. Brock III Chair
School of Chemical & Biomolecular Engineering
Georgia Institute of Technology
311 Ferst Drive, N.W.
Atlanta, Georgia 30332-0100 U.S.A.

February 28, 2020

Dear CTL Awards Committee:

I am very pleased to recommend **Dr. Andrew ("AJ") Medford** for Georgia Tech's 2020 **CTL/BP Junior Faculty Teaching Excellence Award**. In addition to his superb teaching in a core ChBE course (ChBE 2120), AJ has developed a data science course that has now been adopted as a COE-wide course (COE 3803 – Data Analytics for Engineers). He first taught this course as a ChBE elective (ChBE 4803), where the course was met with rapturous feedback from the students. The potential applications of big data of course transcend chemical engineering, so COE had great interest in expanding the scope of this course to be accessible to students from all majors. AJ introduced COE 3803 in Fall 2018 by co-teaching this course with Prof. Eva Dyer from BME. This course took full advantage of the interdisciplinary nature of the students, using case studies that highlighted different disciplines and team projects that engaged students from different majors. As with the first iteration of the course, the feedback from students was extremely positive. Profs. Medford and Dyer taught COE 3803 again in Fall 2019, again to rave reviews. It is clear that this is just the kind of course for which Georgia Tech is and should be renowned – it is technically challenging, mind expanding, and taught with expertise and passion.

The significant success of AJ's undergraduate course was a critical factor in ChBE developing our new online Graduate Certificate in Data Science for the Chemical Industry. This was GT's second graduate certificate to be approved and the first online graduate certificate. The first cohort of students will enter this program in Fall of this year. I have already received positive feedback from many industry partners, academic leaders at other institutions and the national leadership of the AIChE for the visionary nature of this program. The course that AJ developed will become the first core course in this graduate certificate,and he is currently working with DLPE to prepare the course content for this venue. I am convinced that in future years, establishing this graduate certificate will be something that sets ChBE apart from all other chemical engineering programs in the country in a manner similar to the effect GT's OMS CS program has had on the College of Computing. We would not have even considered this path if it were not for the success of AJ's teaching and leadership in this area.

It is rare for an Assistant Professor to take on the task of developing genuinely new elective courses that are appealing and career-relevant to a broad swath of students. It is unprecedented in my experience for an Assistant Professor to lead an academic department in to a new educational realm that will change the department's national and international profile. AJ Medford has accomplished both of these things. In coming years, many GT students will take courses either directly taught by AJ or based on the materials he has pioneered; these courses will propel our students to professional success and intellectual satisfaction. For all of these reasons, Prof. Andrew Medford is the ideal candidate for this award and I give him my strongest recommendation.

Sincerely,

David Sholl

David Sholl
Chair, School of Chemical and Biomolecular Engineering
Georgia Institute of Technology

Reflective Teaching Statement

Andrew J. Medford, School of Chemical & Biomolecular Engineering

INTRODUCTION: I can still remember the first time I solved an engineering problem with a computer: I wrote a Matlab script to simulate beam deformation as a function of time as a weight moved across it. I kept playing with the solution long after the problem was solved, watching how the deformation changed as I varied the modulus, weight, and speed. The "boring" differential equation was transformed into a dynamic and interactive simulation. This experience allowed me to build intuition about an engineering problem, while developing new skills in numerical methods and programming. Afterward, I suddenly felt that my trusty TI-86 calculator was obsolete. I have enjoyed many subsequent adventures in programming, which ultimately led me to a career in computational research, and instilled a passion for teaching the next generation of engineers to maximize the problem-solving potential of computational tools.

TEACHING PHILOSOPHY AND APPROACH: The role of computers in engineering will continue to increase. Computers are becoming more ubiquitous through the development of the "internet of things", the size and availability of large datasets are increasing, and tasks are becoming more automated through machine learning and artificial intelligence. Engineers who are able to work with these emerging technologies will be able to leverage them to solve problems more accurately and efficiently than was previously possible; however, these technologies are complex, and engineering curricula are already filled with a plethora of other indispensable disciplinary topics. This creates an educational challenge for training the engineers of the future. I have approached this challenge by developing new elective courses in data science and machine learning that promote "literacy" in these emerging topics. The goal is to provide engineers with a basic understanding of how to apply these tools and understand their limitations. This will prepare them to work with experts or take higher level courses in computational disciplines.

In addition to the "hard" problem of how to squeeze computational education into an already crowded curriculum, there are a number of "soft" challenges. For example, computational techniques are often seen as dry or boring by students if their utility is not obvious. This can be overcome by assigning problems that have interesting engineering context and real-world relevance. I have found that drawing inspiration from research problems (or letting students work on research directly) helps highlight the practical utility of computational approaches, and that students are particularly motivated by problems related to sustainability and society. Providing this context can turn a "boring" programming problem into an exciting engineering challenge. Another barrier in computational education is the fact that computers come with their own set of jargon that is often foreign to engineers. This can be intimidating to novices, and many students give up on computational approaches because they simply cannot get past the jargon in "introductory" tutorials. This is exacerbated by a competitive environment, especially if there is a large variation in the experience level of students. If your peers already know the jargon, but you can't even get the software installed, then you may feel unable to compete and abandon the class. I try to overcome this barrier by encouraging a collaborative and interactive environment, and by reminding students that the jargon is far less important than the concepts.

CURRICULAR DEVELOPMENT IN DATA SCIENCE Data science and machine learning have been increasingly adopted by a range of industries from consulting to chemical production. Consequently, skills in these topics are in high demand. These fields have emerged at the intersection of computer science, statistics, and mathematics, so most applications have focused on tasks like natural language processing or photo recognition – tasks that are more relevant to advertising

than engineering. However, there are also many engineering problems in areas like process control, materials discovery, and signal processing where machine learning has proven successful. Approaching these problems requires a combination of domain knowledge and computer science literacy that enables engineers to apply existing computational tools, or work with computer science experts who can develop custom solutions. However, the typical chemical engineer working in industry uses Excel as a primary computational tool (Matlab is rarely purchased by companies, and most students do not learn any other programming language). Overcoming this expertise gap will require chemical engineers to become familiar with full-featured programming languages like Python, and gain experience in communicating with computer scientists.

I was excited to have the opportunity to develop a new course to address some of these challenges in Spring 2018. **I created a grad/undergrad elective called "Advanced Data Analysis for Chemical Engineers"** that covered a broad range of topics from data cleaning and organization to machine learning and neural networks. The goal of the course was to expose students to both the practical challenges and advanced aspects of data analysis in realistic scenarios. I taught the course in Python, and provided students with a short 2-week primer to help them transition from Matlab. Although this was challenging for many students, I found that most were excited to learn a new language and explore new topics. I compiled lectures from a variety of sources, and lectured using interactive "Jupyter Notebooks" that enabled me to seamlessly execute code embedded in lecture slides and generate new code through live coding exercises. This provided opportunities to show students how to implement a solution, and then to explore the effects of changing different variables or parameters. I utilized "active learning" to keep students engaged by stopping the class and asking what would happen in different scenarios. The students were able to play with the variables in their own code to come up with answers, and afterward I could demonstrate different scenarios for the class. I found that this interactive style helped keep students engaged, and allowed them to build intuition about how methods were working.

After my experience creating this course I worked with Prof. Eva Dyer from BME to **modify the course into a cross-disciplinary undergrad elective for the College of Engineering**. In the second iteration we interspersed specific "case studies" throughout the lecture topics, and assigned interdisciplinary groups. These provided concrete examples of how data science techniques can help solve real engineering problems from materials design to neuroscience. The course, and the case studies in particular, received very positive student feedback. The second iteration of the course was taught in Fall 2019, and the case studies were developed further into modules that enable more flexible course development in the future. Currently, I have returned to teaching data science to chemical engineering students through a newly-established course, "Data Analytics for Chemical Engineers". This course will be **one of two core courses in the "Data Science for the Chemical Industry" online certificate program** that will launch in Fall 2020. I am excited about this opportunity to teach to a broader audience, and help re-train engineers already working in industry to work with data science techniques.

PEDAGOGICAL STRATEGIES

Incorporating Sustainability And Research With Teaching: I find that students are more excited by computational methods if they are solving problems with societal impact and/or real research implications. I have partnered with the Serve-Learn-Sustain institute by affiliating the "Numerical Methods" course I taught. This involved creating a course project and several homework problems that revolve around the theme of fertilizer production and economics, a topic that highlights how chemical processes interact with society, and how the conditions required to synthesize a chemical can have profound impacts on access and sustainability. I feel that the strategy of "wrapping" a computational or math problem in a context that emphasizes the significance of

chemical engineering to society helps motivate students to work through the challenges they may face when learning a new computational tool. Moreover, these problems are related to my own research, which helps me connect with interested students. I have used a similar strategy in the data science courses, where projects and case studies were often modeled around real datasets and ongoing research challenges. This can cause issues, since real datasets are often messy, and research problems typically do not have clear answers. However, these issues are consistent with problems that engineering students are likely to face throughout their careers, and provide an opportunity for students to apply their creativity to come up with solutions.

Encouraging A Collaborative Classroom: Computers can be intimidating for novice users, and the variance in experience levels for students is typically large. This is especially true for interdisciplinary courses where non-standard tools like Python or the command line are used. My goal is to establish an informal classroom environment that encourages these students to collaborate, rather than compete, so that students with less experience are able to become proficient in the basics of these tools. I do this by assigning groups, and asking students who have a lot of experience to help mentor those who are new. Students are still required to complete assignments individually, but their groups provide them with a support system. This is complemented by a Piazza board where students can ask questions to the entire course, and both asking and answering questions is rewarded with extra credit to promote participation. I also use a flexible grading curve, clustering students by gaps in the grade distribution and assigning letter grades based on performance. This enables a large percentage of the course to receive high grades (as long as their performance justifies it), rather than forcing students to compete for a finite number of A/B's. The strategy was successful for the data science courses, where roughly 70% of students received A's and nearly all of the rest received B's. However, most feedback, including numerous CIOS comments, indicated that the courses were very challenging. This indicates that even students who come in with little or no prior experience are able to be successful, and that they are motivated to work through the assignments even though they find them difficult.

Promoting Student Wellness I recognize that engineering education can be stressful for students, and feel that it is important to create a classroom environment that promotes wellness. I attended the "Creating Conditions for Well-Being in Georgia Techs Learning Environments" workshop in 2018, and incorporated several strategies to minimize the stress induced by the challenging topics in my courses. I experimented with "rotating groups" for each module in the Fall 2019 offering of "Data Analytics for Engineers" to encourage social connections across engineering disciplines, and used 2-week assignment cycles with extra credit for early submission to provide more flexibility. I have also attended QPR training in Spring 2020, and include information about campus resources in the syllabus of my courses. I hope these actions, along with the collaborative classroom environment, help students maintain mental well-being and promote awareness of resources to help any who are struggling.

ADDITIONAL TEACHING AND SERVICE In addition to the data science courses, I also **teach a "vertically integrated project" (VIP) course** on "Big Data & Quantum Mechanics" every semester since Spring 2017 (roughly 18 students per semester). This research-based course requires students to learn to use even more advanced tools for scientific computing. In the first "training" semester students learn to use the PACE supercomputing cluster to perform quantum-mechanical simulations with existing code. This promotes skills in UNIX and Python, and provides students with experience in high-performance computing. Perhaps more importantly, this creates an environment where engineering students can work closely with students from diverse backgrounds. The course is interdisciplinary, with roughly half of the students from computer science and half from engineering or physical sciences. This requires engineers to learn how to explain problems

to computer scientists, and gives the computer scientists experience working with non-standard problems. The course also provides a low-barrier entry into undergraduate research, and returning students work closely with graduate students to write papers or software for active research projects.

I have also **organized two "Carpentry" workshops**, Data Carpentry (Sept. 2019), and Software Carpentry (May 2019). These workshops included undergraduate and graduate students, along with postdocs and even a few faculty members interested in learning the basics of data analysis and software development. These 2-day workshops focus more on practical skills than theory, and help students overcome the barrier to get started with programming techniques. The workshops inspired me to work with Prof. Mark Losego and collaborators at "Citrine Informatics" to **develop a new 2-day workshop, "Materials Informatics 101"** (Sept. 2019), based around the philosophy of the "Carpentries" workshops but focused on applications in materials data analysis. These workshops help democratize programming education and increase accessibility of data science techniques for engineers.

REPRESENTATIVE CIOS COMMENTS:

ChBE 2120 - Numerical Methods For Chemical Engineers (F17, Co-Taught With Paravastu)

- This was a really intense course, but I think that expectations were fair and we were explicitly told what we needed to do to succeed. Although it literally gave me a nightmare or two, I enjoyed learning from the instructors and feel like it was worth all the effort I put in.
- This course was extremely challenging but it gave me a new perspective on how to approach problems and how powerful numerical methods can be.
- Dr. Medford's respect for us and genuine desire to help us succeed was apparent. His notes were very helpful and comprehensive.

ChBE 4803/8803 - Advanced Data Analysis For Chemical Engineers (S18)

- Professor Medford understood that this was the first time some of us had ever been exposed to Python, and I felt like he fairly framed his own expectations from us around that. The course was challenging for beginners with Python, but it was definitely still possible to do well after getting through the initial learning curve.
- Data analysis is a very hot topic in industry right now and knowledge of these skills is invaluable for many career paths. My python coding skills have improved dramatically, and I have been introduced to many different models of data analysis. While I may not remember exactly what each clustering or classification method is five years from now, I now have the ability and resources to review these topics in the future if I never need to.
- Great class. Definitely challenging at times, but I felt like I learned so much and was exposed to a field I'd never even thought about before.
- Dr. Medford did a great job of keeping lectures engaging and interesting. The classroom environment was very informal and casual, which I think helps students relax and actually improves attention span.

COE 3803 - Data Analytics For Engineers (F18, Co-Taught With Dyer)

- Dr. Medford was extremely passionate about this subject, and you could really see it in his teaching. He was a phenomenal professor and able to sprinkle in his own bits of personal insight into nearly every lecture that made it all the more valuable.
- Literally everything in this class was phenomenal so far as facilitating learning. The lectures were fast, but an engaging and challenging speed that were well prepared to enable you to complete homeworks and feel confident in your knowledge. I believe the inclusion of the case studies really put this class over the top as why it has been my favorite class ever. Using real datasets to apply the techniques learned on the case studies helped me see the actual use

cases for the techniques as well as challenges of the implementation and expected outcomes.
- I like how this course was a broad overview of the application of existing data science techniques rather than a CS-style course where we would delve very deeply into certain topics at the expense of others.
- I really can't commend y'all enough on the quality of this course. I believe the case studies were extremely well executed with the amount of pre-work that was put into it so that we could focus on the primary learnings of the class such as algorithm implementation and feature engineering. I enjoyed the random group pairings as it was my first time ever since Grand Challenges freshmen year to work in a group with students of other majors. I got to work with ECE's, ME's, and BME's where we were all able to share our separate experiences and knowledge, and I thought it worked phenomenally!

ChBE 2120 - Numerical Methods For Chemical Engineers (S19, Co-Taught With Paravastu)
- Dr. Medford had a very clear goal in mind when he presented material in lecture, and would move promptly through the material, making sure he explained the most important aspects as related to the course.
- I also appreciated how sometimes he would solve the problems as the students were solving them to show more realistically how much time it would take to solve a given problem.
- Very passionate, accessible and enthusiastic. Wants to make sure everybody understands him.
- The problems Dr. Medford worked in recitation were on a comparable level to test and quiz material, but he covered them slowly and thoroughly, allowing me to gain understanding.

COE 3803 - Data Analytics For Engineers (F19, Co-Taught With Dyer)
- Dr Medford answers not just what you're asking, but what you don't even know you meant to ask.
- I think Dr. Medford's greatest strength was his ability to convey somewhat abstract concepts with simple examples.
- Makes sure to underscore common points of confusion for students, and very understanding of the different dynamics (largely due to various backgrounds in Python) students have entering this course.
- Teaches concepts at the appropriate intellectual level. Not too complex but not too simple.

Course Surveys (CIOS)

Andrew J. Medford

Item 10: Considering everything, the instructor was an effective teacher

TERM	YEAR	COURSE			CLASS SIZE	5: strongly agree	4	3	2	1: strongly disagree	N/A	NO. OF RESP.	INTER-POLATED MEDIAN	NORMATIVE DATA (per class size -- see notes)	
														GT median	CoE median
Fall	2017	CHBE	2120	XX	108	36	38	18	8	1	0	101	4.1	4.57	4.52
Spring	2018	*combined - CHBE4803/8803*			41*									4.57*	4.48*
		CHBE	4803	XX	24	16	2	1	0	0	0	19	4.9		
		CHBE	8803	XX	17	8	4	1	0	1	0	14	4.9		
Fall	2018	COE	3803	XX	31	21	7	1	1	0	0	30	4.8	4.60	4.60
Spring	2019	CHBE	2120	XX	99	32	39	15	2	1	5	95	4.2	4.60	4.50
Fall	2019	COE	3803	XX	38	24	10	2	0	0	0	36	4.8	4.60	4.50

Notes:

Class Size Ranges: (< 16), (16 - 35), (36 - 99), (> 99)

* Asterisk indicates normative data that uses the overall class size of all course sections

Anant K. Paravastu
Associate Professor
School of Chemical & Biomolecular Engineering
311 Ferst Drive, N.W.
Atlanta, Georgia 30332-0100 U.S.A.
PHONE 404-894-2874 FAX 404-894-2866
anant.paravastu@chbe.gatech.edu

Dear CTL Awards Committee,

Are 43-year-old tenured professors like myself allowed to have favorite teachers? I am not referring to teachers from my past, though I hope all old people have favorite teachers from their past. Dr. Andrew J. Medford is very much a favorite teacher from my present. I started learning from him when I attended his lectures in Fall of 2017, when he taught the course ChBE 2120 Numerical Methods for Chemical Engineers. Since I had taught this course a few times myself, and this was Dr. Medford's first time teaching, I was assigned by our department to minimize the anticipated disaster. Before the semester started, I gave Dr. Medford my notes with a pep talk on caring for our students, and agreed to run office hours and problem solving sessions to support the class. In the beginning of the semester, I thought I would attend Dr. Medford's first few lectures to show my support. It turned out I was in for a surprise. I found Dr. Medford's lectures so interesting, I ended up attending his lectures for the whole semester. Below are my thoughts on why Dr. Medford is such a great teacher, and why I believe he is a most deserving recipient of the CTL/BP Junior Faculty Teaching Excellence Award.

Great teachers inspire without discouraging. It is clear that Dr. Medford loves learning. His lectures are concise, precise, and thoughtful. Though numerical methods and chemical engineering analysis can be quite intimidating, Dr. Medford presents his lessons in a way that acknowledges the difficulty but also expresses faith in the abilities of the students. In fact, students could tell that he too was struggling: he was constantly struggling to find the best way to help them. Moreover, Dr. Medford was not satisfied sticking to the specifics of the curriculum. Into his lectures, he worked in lively discussions about things like mathematical complexities and the responsibility of engineers to achieve sustainable and ethically responsible chemical processes. This current semester, it is my turn to present the lectures for this course. Dr. Medford now attends my lectures. After each lecture, in a disarmingly gentle way he provides me with hints about things I could have presented better. I am most grateful for his mentorship.

Great teachers innovate. In fact, after I patiently showed Dr. Medford how to teach ChBE 2120 Numerical Methods, I learned that he has proposed eliminating the course from our program. I will start this discussion with a little background. We now think of Numerical Methods as being a course on structured programming, but when I was a student that was not the case. When I was a student I was forced to perform numerical methods with paper and pencil by professors who acted like they were themselves taught by Isaac Newton (1642-1727). As long as I have been a chemical engineer, I have always found it difficult to convince most chemical engineering students to learn to code. With Dr. Medford's proposed changes, coding skills will be so integrated into our program that students will find it hard to imagine doing things any other way. As Dr. Medford thinks about how to eliminate my favorite course, he also thinks about how to use new technology to make more immediate improvements. He is regularly coming up with ways to encourage students to build a community and answer each other's questions via Piazza. I was used to hearing the chirping of crickets when monitoring Piazza discussions for my classes. With a new system of extra credit for Piazza posts that help other students, I witnessed a collaborative online discussion with clear evidence of increased sophistication as students' skills grew. Last year, Dr. Medford pushed our class to go fully paperless, employing Gradescope.com to provide a means of efficient, private, and fair evaluation of student work.

Great teachers push people out of their comfort zones. I have hopefully already made it clear that Dr. Medford challenges his students to solve problems and innovate without fear. I would add that his exams are tough; I am glad I did not have to take them. While students were initially concerned (even outraged) by the difficulty, I saw them rise to the challenge like Georgia Tech students always should. Dr. Medford not only challenges his students, but he also challenges his instruction team. Graduate teaching assistants are encouraged to lecture to the class with us professors in the audience. They are also encouraged to actively work with us on exam and project formulation and grading. Undergraduate teaching assistants are encouraged to prioritize interaction with students during office hours and share their experiences from subsequent course in the curriculum. All instructors work together to come up with challenging homework problems.

I think I can sum it up by recalling the enthusiastic applause the Fall 2017 class gave to Dr. Medford at the end of his last lecture. He seemed to think it was no big deal; students had never clapped for me. I knew why they were clapping, because I felt it too. For a moment, I felt like a 20-year-old ready to save the world with awesome engineering skills. Thanks, Dr. Medford!

Sincerely,

Anant K. Paravastu

Georgia Institute of Technology

College of Engineering

Georgia Institute of Technology
Atlanta, GA 30332-0360

February 28, 2020

It my pleasure to write this letter to support the nomination of Professor Andrew (AJ) Medford for the CTL/BP Junior Faculty Teaching Excellence Award.

Professor Medford is one of Georgia Tech's most gifted and caring teachers, and he is truly deserving of this award.

As the Associate Dean for Academic Affairs of the College of Engineering at Georgia Tech, and as a professor with more than 30 years of academic experience at Georgia Tech, I have come in contact with a large number of excellent instructors; I think that Professor Medford is one of the most talented and energetic young classroom instructors that I have ever seen.

I first met AJ at our new faculty orientation, and I was immediately struck by his passion for engineering education. This assessment of him was confirmed when I worked with AJ and Professor Eva Dyer on the development of a new special topics class in Data Analytics for Engineers; they team-taught this class in Fall 2018 and again in Fall 2019 as COE 3803. AJ accepted this assignment without hesitation – demonstrating that he is an excellent Georgia Tech citizen – and worked diligently throughout the Spring 2018 semester to develop a class that should be the model of how we can teach data science to all of our engineering undergraduates in the future.

AJ and Eva were team players who solicited input and opinions from multiple faculty and students across the College of Engineering. The student feedback and instructor assessments showed that their COE 3803 course in Fall 2018 and Fall 2019 has been a great success. They have subsequently presented their assessment results from this class to the College of Engineering leadership, with the intent of making a future version available to all of our 9000 undergraduate majors.

In summary, Dr. Medford's teaching skills are extraordinary, and he has truly improved the academic environment at the Institute – I heartily recommend him for this award.

Sincerely,

Laurence J. Jacobs
Professor and Associate Dean for Academic Affairs

Dear CETL Awards Committee,

I'm incredibly delighted to have learned about Dr. Medford's nomination for the 2020 Junior Faculty Teaching Excellence Award! I have been asked to reflect on his excellent and dedicated teaching as an instructor for one of my first chemical engineering classes, CHBE2120: Numerical Methods in Chemical Engineering. But after he left a strong first impression, I knew my growth as a student would benefit with his additional guidance. It is an honor and my pleasure to speak about Dr. Medford's qualities, not only as an instructor for a class I am currently taking, but now as my research PI and mentor as well. I offer a profound recommendation for his recognition as an outstanding member of the ChemE faculty and community with the 2020 Junior Faculty Teaching Excellence Award.

My first interaction with Dr. Medford was through my first chemical engineering class as a transfer student, Numerical Methods in Chemical Engineering (CHBE2120). As a co-instructor for the course, Dr. Medford's role was more reserved yet still important – his presence and his contribution were valuable nonetheless. From the beginning of the course, it was evident that Dr. Medford was dedicated to his students. Although lecturing ~100 students was not his primary role and in fact not required, he still made it a priority to come to lecture at 8:00am, a task a few of my classmates and I struggled to wake up for at times. Dr. Medford's regular presence was reassuring to the primary instructor and the students knowing that there was always someone to clarify difficult concepts. Whenever some confusion was sensed in the lecture, he intervened to explain concepts in an alternative manner. Outside of lecture, Dr. Medford was always approachable for help and advice. In addition to office hours, he held optional problem-solving sessions which were usually full. He took his time to dissect problems and to give advice on succeeding in this difficult course. But more notably, his teaching style stressed the importance of showing understanding first and foremost, which is something I now strive for in all of my courses. His reputation as a talented and dedicated instructor has earned a lot of admiration from his former students in CHBE2120.

Dr. Medford's innovation as an instructor comes in the form of a newly designed class for chemical engineering undergraduate and graduate students. Adapted from a course in the College of Engineering, Dr. Medford has created a data analytics course for chemical engineering, CHBE 4745. When I was informed of this elective, I knew I had to take it as I could trust Dr. Medford to teach material that would be useful for my future. While there are inevitable challenges with initiating a course, Dr. Medford has succeeded in shaping an environment that is conducive for undergraduate and graduate students. He has created a balance in the material and assignments so it is doable for undergraduates but still engaging for the graduates. Additionally, Dr. Medford has made it a goal for us to apply what we have learned in practice. The projects done in this course involve datasets that are collected from real processes and research. This gives students a real perspective on chemical engineering and an appreciation of the complexity of such processes. Dr. Medford has done an incredible job so far of combining the beauty of chemical engineering principles with data analytics. I can't wait to see what the future holds for Dr. Medford's course as I'm certain it will be a staple of the curriculum in the future.

After being exposed to Dr. Medford's classes, I decided to join his research group to expand my knowledge of the application of data analytics into chemical engineering. Dr. Medford has assigned a project and a mentor for the remainder of my time at Georgia Tech. He has been patient and understanding with my progress even when I have been unsure of my contributions, which is something I greatly appreciate. It is reassuring to know that I can always trust him for guidance and resources when working on my project.

Dr. Medford's qualities have made him an impactful figure in the chemical engineering department. He has impacted my life and others' and has inspired me to be dedicated in the role that I have in the community. I strongly believe that he is outstanding representative for the chemical engineering department and is deserving of the 2020 CETL/BP Junior Faculty Teaching Excellence Award.

Sincerely,

Adhika Retnanto

Chemical and Biomolecular Engineering, Class of 2021

Georgia Institute of Technology

Dear CTL Awards Committee,

This past Fall, I had the opportunity to study data analytics with Dr. A.J. Medford in his newly offered Data Analytics for Engineers course. As a civil engineer, a professor from the School of Chemical and Biomedical Engineering was an unknown in my consideration of the course, but throughout the semester I was able to learn from Dr Medford as both a lecturer and a colleague.

Dr. Medford quickly became a lecturer I looked forward to learning from every week. From the skill and clarity in his presenting ability to the comfort and excitement he feels for both students and materials, Dr. Medford's classroom cultivates a space where the eagerness and opportunity to pursue knowledge flourish. Dr. Medford takes great care to ensure that his lectures prioritize a theoretical understanding of concepts while actively recognizing and incorporating common applications. In my experience, this allows Dr. Medford to connect with students while teaching in an area where many fall short. In lecture, in homework assignments, in testing environments, Dr. Medford consistently communicates the value of course material with a method almost universally appreciated by students. In a classroom filled with students from a variety of engineering disciplines and backgrounds, Dr. Medford's ability to help every student see purpose and personal importance in course material is an increasingly rare skill deserving of recognition.

In addition to learning from Dr. Medford as a lecturer, I had the additional opportunity to work with him as a colleague. For our final class project, my group and I partnered with Georgia Tech's Serve Learn Sustain program and the West Atlanta Watershed Alliance to perform a comparative analysis between the local Proctor Creek in Fulton County and the greater Chattahoochee River it as a part of. Because of the extended scope and audience of my group's work, I had the opportunity to collaborate with Dr. Medford to determine a specific guiding purpose for our case study before we began. In this experience, my appreciation for Dr. Medford as a professor grew into a respect for him as a member of the community. Despite being much more knowledgeable than us and eventually being the one to grade our work, Dr. Medford interacted with my group and I as peers. He recognized our strengths and valued our opinions, actively keeping his perspective open and remaining humble while guiding us. His excitement for the project and his excitement to serve his community translated into an excitement to learn from us as well as to teach us. The opportunity to serve alongside Dr. Medford expanded my perspective of him outside of the classroom and greatly contributed to my respect for his involvement in our community and his talent as an incredible professor.

Thank you for the opportunity to illustrate Dr. Medford's character and teaching skills as an excellent selection for the CTL/BP Junior Faculty Teaching Excellence Award.

Quinn Knapper
qknapper3@gatech.edu

February 21, 2020

Subject: Letter of support for Dr. A. J. Medford for the CTL/BP Junior Faculty Teaching Excellence Award

Dear CTL Awards Committee,

My name is Shashwati Claudina da Cunha, and I am a 3rd year Chemical and Biomolecular Engineering student at Georgia Tech. I am writing this letter to support the nomination of Professor A. J. Medford for the CTL/BP Junior Faculty Teaching Excellence Award. I took CHBE 2120: Numerical Methods in Chemical Engineering with Dr. Medford as co-instructor, as well as his novel interdisciplinary class, COE 3803: Data Analytics for Engineers.

Most engineering classes rely on foundations built since elementary school. First we learnt to add numbers, then symbols, then rectangles with an integral sign at the front… But the material Dr. Medford taught me had no precedent. Before I took Dr. Medford's classes, I was content with tidy equations and the notion that the "real world" is too complex to ever really predict. But numerical methods and data analytics are powerful toolkits that allow problems to define themselves and resolve incredible complexity into meaning. No calculus class prepared me for the exhilaration of generating equations that fit 40-dimensional datasets, or predicting the outcomes of decades of sports tournaments.

Dr. Medford was able to pass on this excitement in his clarity of instruction and patient work through challenging material. To me, the core of his teaching abilities lies in his willingness to listen. Dr. Medford is the most perceptive professor I've ever had, delving deep into his conversations with students to address the heart of the discussion. Whether in lecture or office hours, he would consistently answer not only questions I asked, but ones I didn't even know I was trying to. By the end of Data Analytics, I would ask questions just to see what insights he could reveal. This was especially valuable in an open-ended class with little precedent and vast applications – I found office hours both grounding and exploratory.

Dr. Medford's problem-solving style reflects this perceptiveness as well. In my list of quotes to live by is his advice from Numerical Methods: "If you're inverting a matrix, you don't know what you're doing." The implicit advice is to listen to the data and let it guide an approach, rather than relying on standard methods. Machine learning models work by using what's known to make predictions. In the same way, Dr. Medford was responsive and adaptive throughout the semester, whether in reordering assignments or modifying notes. Each iteration of his class has become more focused and addressed its weaknesses. For instance, both faculty and students in Numerical Methods pointed out that coding in Python was an essential skill. Data Analytics addressed this from the beginning. I've also seen changes in the latest version of the class that directly respond to challenges I struggled with.

Engagement and interaction give Dr. Medford a unique strength in teaching collaboratively. He has mentored a very successful support team for classes, whether through his feedback on student-led review sessions or by allowing undergrad teaching assistants to design entire assignments. I've seen TAs grow throughout the semester under his guidance. Even in lectures led by co-instructors, his comments were always insightful and constructive.

Dr. Medford's respect for others' ideas makes him a motivating mentor. As an end-of-semester project in Data Analytics, I worked with an interdisciplinary team to make recommendations for process improvements using a real-world dataset. This open-ended, immersive project led us into many challenges. At the height of our frustration, when I'd begun dreaming that datapoints were pushing me out

of my bed, Dr. Medford sifted through our confusions to patiently remind us of our own project proposal and the goals we'd set ourselves. He gave us just the right amount of advice – gentle warnings against certain approaches, hints at promising leads. He reframed the challenges we were facing in the context of our project and its implications in real life. This gave us flexibility to take ownership of the project and enough guidance to not drown. In 30 minutes after meeting him, we gained more direction than the previous week. By working with us and adding on to our ideas, he gave us a path to grow and refine the project in our own ways. This is what a good professor is to me – rather than fitting us into an algorithm, he taught us to train our own learning model, refine and cross-validate it, test it and ultimately use it to push ourselves to a new level.

Dr. Medford's classes are spaces to admire mathematical elegance, find meaning in noise, and mine the unknown landscape of data. I still go to office hours for Data Analytics sometimes, just because I miss this way of thinking. Data analytics is the driving force for growth in chemical engineering right now. I hope that Dr. Medford's recognition through this award will signal students' appreciation for classes that bridge the gap between cutting-edge technologies and departmental curricula. I wholeheartedly support his nomination.

Yours,

Shashwati Claudina da Cunha