

Application Summary

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Application Information

Submitted By: Sandra Maffey

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Application Details

Proposal Title

Todd Fernandez Nomination for the CTL UG Educator Award

February 18, 2021

Awards Selection Committee
Center for Teaching and Learning
The Georgia Institute of Technology

Dear Members of the Awards Selection Committee:

It is with great pleasure that I nominate **Todd Fernandez** for the *CTL Undergraduate Educator Award*. Todd is a Lecturer in the Coulter Department of Biomedical Engineering, and joined our department in 2018. He was hired as part of our departments' ongoing engineering education innovation efforts. In his role as a lecturer in the BME department, he undertakes a variety of educational responsibilities including teaching, faculty development, and research on innovative educational practices. In each of these areas he has had a strong positive impact on BME undergraduate student's success and our departments' undergraduate educational innovations.

Todd has displayed his teaching excellence in two course in our core undergraduate curriculum. The first course is BMED1000 – *Introduction to Biomedical Engineering*. Todd led the development of BMED1000, its introduction into our required curriculum, and scaling the class up to support 300 students per year. He teaches 4-6 sections of this course per semester, while managing all aspects of the course including an active and structured continuous innovation effort. The second course Todd teaches is BMED2400 – *Introduction to Biomedical Engineering Statistics*, our required undergraduate statistics course. Todd has developed major course revisions that draw on student collected data, biomedical engineering contexts, individualized projects, and other innovations that draw on best practices in statistics education literature. He has established a reputation as an empathetic and caring instructor who is deeply focused on students' success and mental health. The results have been extremely positive course feedback from students. He has also worked in a mentoring role for several other instructors who have adopted his innovations in their own offerings of the course.

In his teaching, Todd has been highly recognized by his undergraduate students for his efforts and his excellence. The letters of support contained at this end of this packet are true reflection of his commitment. They speak to his impact on students' lives as well as how he uses educational innovation and a passion for teaching in exemplary ways. The letters parallel consistently excellent CIOS scores from all of his classes. Both in BMED1000 and in BMED2400, his scores are consistently above COE norms. During the summer of 2020, his CIOS scores for BMED2400 were a perfect 5.0 while teaching an online, optionally synchronous, course for the first time. Across both classes, he regularly receives other recognitions from undergraduate students including at least three 'Thank a Teacher' notes via CTL.

In addition to his teaching, Todd has also actively contributed to a number of undergraduate educational innovations throughout the Biomedical Engineering Department. He has helped lead two major educational innovation grants in our department. In the first, our NSF Revolutionizing Engineering Departments (RED), he worked to revise our undergraduate curriculum to create more inclusive engineers. One example of his work on that grant involved mentoring a team of Pre-Tenure Assistant BME Professors in a significant revision of our required undergraduate biomechanics course. Through meetings and individual coaching sessions over the course of a year, Todd helped his colleagues shift their perception of their role in a classroom, increase the amount of group problem solving in the class, and learn how to better communicate their care for students and their success. The other grant is from the Kern Entrepreneurial Engineering Network (KEEN). In our KEEN grant, Todd has been instrumental in a implementing a vertically integrated curriculum across seven of our required undergraduate courses. The curriculum focuses on implementing educational innovations including reflection, ePortfolios, and story-driven learning to help students see themselves as engineers who create value and think critically. The success of this grant in BME has led to the recent award of a second grant to scale the educational innovations developed in BME to three other

departments at GT. He has also built partnerships with the Carter Center that bring real global engineering challenges into BMED1000 and with AutoDesk© to improve the teaching of Computer Aided Design software. Beyond these external partnerships, Todd has also had led a significant amount of other faculty development work for the department and is constantly available to other faculty who have questions or ideas about how to improve their courses.

The best examples of his work on faculty development with BME faculty come from his assistance with transitioning to online education during the spring of 2019. In preparation for transitioning his own course to online, Todd began compiling resources and best practices for online education and supporting any faculty with questions about how to transition their own courses. During spring break and the online test and tune week, Todd created and hosted several workshops on available technologies and effective techniques. He also held 'online education office hours' for faculty throughout the first weeks of the transition. When faculty noted concerns about secure methods of remote assessment, he developed resources including checklists and guidance documents on how to reduce concerns about cheating in online courses without unfairly impacting conscientious students. He also developed a survey tool that we continue to use a year later to gather information on students' experience in our classes. The tool, which is the subject of a forthcoming peer reviewed journal article, enabled us to provide department wide feedback, recognize faculty who excelled, and help faculty who were struggling with the transition to online education.

Finally, it is important to recognize Todd's contributions to undergraduate engineering education scholarship and the dissemination of innovative practices at and beyond GT. Although employed as a lecturer, Todd continues to perform and publish research in engineering education. This work has resulted in multiple publications on innovations developed or implemented in his classes including grading, reflection, faculty development processes, and students' perception of engineering work. He has also brought an educational research and theory perspective to our department's undergraduate curriculum committee that has benefited the analysis of new course proposals and policies.

In summary, Todd is an integral member of our undergraduate educational faculty and a valuable contributor to other faculty member's own teaching practice. Every day he strives to build a community of excellence in biomedical engineering education in our department and beyond. It has been a pleasure to see the profound impact he has had on our undergraduate students and faculty, even during this most challenging of times, and as such, I am very proud to nominate him for this award.

If you need any further information regarding Todd's candidacy for this award, please do not hesitate to contact me.

Sincerely,



Susan S. Margulies, Ph.D.
Georgia Research Alliance Eminent Scholar in Injury Biomechanics
Wallace H. Coulter Chair

SSM/sim

Nomination of Todd Fernandez for the 2021 Georgia Tech Center for Teaching and Learning Undergraduate Educator Award

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Reflective statement on teaching

I design courses with my engineering mindset: Use evidence- and science-based reasoning to create experiences that achieve a specific learning goal in an explicit and intentional way. To me, that mindset starts with stating a problem. In my perspective that problem is: *Engineering students who adopt a passive, rather than active, role in their own learning*. It may seem academic, but that structured and planned approach has allowed me to find enormous joy in teaching because I know the basics. My goal as an educator is to help students learn the material in my course, ***but my joy in teaching is a second goal - empowering students to take an active role in their own learning***. Towards both goals, I have three principles I follow in my teaching: (1) Structure and reward reflection as the foundation of learning, (2) Put engineering learning in real-world contexts with relevant expectations, and (3) Build a relationship of trust between me and my students. Each principle builds on educational research and I use each to achieve different goals in teaching engineers who take ownership of their life-long learning.

The experience that made me feel like I found my footing as a lecturer at GT was ***getting engineering students to like homework so much they mention it in CIOS***. In the summer of 2020, I rethought my normal statistics homework format to better align with the online version of the course. In the new homework format, students were required to correct prior mistakes, expected to compare their own work to a solution, and graded on completion of those tasks rather than accuracy (i.e., reflection was structured and rewarded). I anchored every question in real data sets with each problem centered on making decisions or suggesting actions based on calculations (i.e., put engineering in context). I then explained my reasoning for the format, was transparent that it was an experiment, and set a date where we would reassess if it was working (i.e., acted to build trust). During the semester I checked in and heard no complaints besides a few questions about, what to do when they got answers right (*answer: still do the solution comparison and note any differences between their approach and mine*). My shock came when I started reading the CIOS comments and saw how well the approach was received. The shock was not just that students seemed to like the new homework, but because they mentioned my three principles explicitly in their CIOS comments. In CIOS ***homework was mentioned 38 times*** – all positively. Students mentioned the real data, that the problems had a context beyond just numbers, and the value they saw in reflecting on their prior work. The best comment to me was simple and easy to pick out. When asked about the best aspect of the course, one student commented simply *“The homework assignments.”* I was floored – I couldn’t ask for better evidence that the principles work.

(1) Structure and reward reflection

My first principle is to create consistent opportunities for students to self-assess and self-correct. Like everyone, I give students work to do. Where I differ is **that each task is accompanied by reflection on how they knew what to do, what they got wrong, and what they understood or did not**. Those reflection opportunities are structured to target specific aspects of knowledge, understanding, and process that are at the heart of an assignment. Asking a good reflective question is necessary but not sufficient to ensure the authentic engagement necessary for this technique to achieve its goal. If I don’t reward that reflection, I am only rewarding the student for demonstrating knowledge to me. Naturally, students will focus their time and effort on proving to me they know the material rather than proving it to themselves. While I’m always excited to see (and celebrate) students’ learning, I recognize that in only a semester I will be a memory and they will need to be self-reliant in checking their use of the foundational concepts taught in my courses. So, I rely on the primary currency faculty can use to communicate value in a classroom - grades. I reward reflection by making it part of a grade, so as to motivate students to engage in reflection and build responsibility for their learning. I value such reflection because, it is so critical. The educational philosopher John Dewey described it perfectly over 100 years ago: “We do not learn from experience...we learn from reflecting on experience”.

That repeating cycle is what I explicitly design courses and activities to follow. I create an experience and then an opportunity for students to reflect on it. In my statistics course, this cycle is the basis of every problem students solve from day one of class. Whether worked on the board, on homework, or a test, students start by listing what course concepts are relevant. They then work to solve the problem, either on their own or collaboratively – experiencing what works and does not, often necessitating a revision of their list of relevant concepts. I always follow that experience with an opportunity for structured reflection after students have received feedback. On homework, students are only given formative feedback about their performance on a homework assignment (grades are assigned based on completion not correctness). ***They are then rewarded on the next homework for reflecting - half of their grade comes from comparing their work to the feedback and a solution I provide.*** To

earn that half of the credit they must answer a set of reflective questions about what they got wrong, why they got it wrong, and how their understanding has changed. I use a similar approach on tests. Students are given both summative and brief formative feedback on their test. They can then earn partial credit back by correcting their answers without solutions and by submitting a reflective statement. The reflective statement is the ‘ticket’ that allows them to get points back. In one semester of stats we cover the basics, but I am also teaching my students how to learn more advanced statistical tests on their own, by continuously evaluating their own knowledge.

(2) Put engineering in context

My second principle is putting the way I teach engineering into as realistic a form as possible. When I worked as an engineering manager, **a constant area of mentorship was that I didn’t employ young engineers to give me a number, but rather to tell me what that number means and what to do with it.** So, when I teach, I seek to take the content covered in my classes and put students to work using the content as they will: Problems begin with insufficient information, students are expected to find information on their own to understand the real-life stakes of the problem and to give me decisions, opinions, and arguments – *not just numerical answers.*

As with reflection, putting engineering in authentic contexts is an ongoing effort in engineering education – and for good reason. Similar techniques are common in collegiate engineering design courses, where calls for authentic design projects abound. However, I seek to go further, not just making the problem realistic, but making the expected outcomes I ask of students realistic as well. That is because in context engineering work varies enormously in complexity. One way it varies in complexity is the types of expected outcomes, so I choose a variety of expected outcomes that are situationally appropriate. I might pick a low complexity problem for a test (e.g., decide whether to order a biopsy), a higher complexity problem on a homework (e.g., write guidance on interpret the accuracy of COVID-19 tests), and an even more complex one for a team-based project (e.g., design a strategy to educate the Chadian population about Guinea Worm Disease). ***Varying the expected outcomes lets me match the complexity of the real-world work with the course context in which students will encounter the problem.*** If I do not manage the complexity of expected outcome, students can feel overwhelmed and disengage with my attempts at authenticity. That can mean they approach my course as a task-completion rather than learning exercise – i.e., school returns to being a game of points. In practice, I consider whether students will be working individually or in groups work, whether the task is for a test vs. homework vs. project, and how far students’ level of knowledge has progressed. That way, each problem and activity is in the context of realistic engineering, with a level of complexity that is appropriate for the course context to make learning achievable.

An example of putting engineering in context comes from BMED1000. There, I developed a partnership with The Carter Center to create a semester long freshman design project centered around one element of the eradication of Guinea Worm Disease. The choice of project was specific to our incoming biomedical engineering students; the experience in the COVID-19 pandemic provides a new context where they see a role for engineers in public health. This helps students see the challenge presented to them as realistic and engage in the need to understand users and define a clear problem that they can design a solution for. However, it also means managing the complexity students perceive along the way. The Guinea Worm Disease project has solutions that typify engineering projects (filters, infrastructure, chemical treatment) However, to do the engineering work, students must understand how the project is nestled in individual, household and community behavior; the beliefs of those with very different lives than my students know; and within a socio, economic, and cultural contexts that students struggle to identify with. Working in that complex context takes patience and support. To do this, we set up teams of 4 students, guide them through a structured semester-long process, and managed the scope of what they were asked to do. The direct impact of managing complexity is apparent in a comment from one student who said:

“I thought I wouldn’t like the guinea worm disease project at first, since others have already poured tons of money and decades of time into solving it and I’m like, a freshie. But now, I feel like my group and I came up with a really great original idea and I actually really like it. The project led to a mindset transition from ‘oh jeez I don’t think I can come up with anything that would actually be good that nobody else has come up with’ to ‘yeah turns out I can’”

In my statistics class, which is more traditional, the problems can look very different – but remain a task relevant to engineering but with different levels of complexity. A test problem might ask students to decide whether to order follow-up screening for a cancer patient. What matters is that the students always see the work they are

doing as engineering work – *not just theoretically connected to engineering work but as engineering work*. Seeing it that way gives gravitas to the content, but means I cannot blind them with complexity either.

(3) Build a relationship of trust

My third principle is about establishing a culture in my courses that helps my way of teaching work. While the first two principles are grounded in research on how people learn, building trust is grounded in creating a classroom environment that values authentically embracing those ways of learning. So, in every interaction with a those in my course, even before the semester starts, I work to establish that I care about their learning, their success, and them as people. Doing so counters a mindset of my course as a points-based game for a grade. More importantly, **it makes my classroom a safe place to learn – which requires being a safe place to fail**. Taking responsibility for the trust they require to approach learning differently comes directly from one of my favorite pieces of educational research: An article in the Proceedings of the National Academy of Sciences reported that **people in undergraduate programs believe that they learn more from a lecture than active learning, even when data from those same classes proves the opposite is true**. But using evidence-based approaches to learning isn't enough, what is important is how I go about it. Because research also shows that caring alone is insufficient – the **perception** that my class can trust me and that I care about their learning can improve outcomes.

My illustrations of teaching excellence section shows **that building a relationship of trust is more central to learning more than any other principle**. In class, I use tools (e.g., *specifications grading*¹) that build trust through transparency – and also help learning. However, examples of how I build trust are typically simpler and reflect my beliefs about the role of educators in learning. I start with approaching trust as a conscious endeavor that must be built (not expected), which can only be built from **mutual** trust. In my mind, if people in my course don't regularly say things like “*Todd cares an exceptional amount about our wellbeing as people outside of the classroom.*” I'm not sure why they would bother trying their hardest to learn from me. The other two principles require those people to embrace learning as more than transactional. That embrace can only happen if I role model a non-transactional approach to learning as well.

The foundation of my efforts to build trust in a course is recognizing, and embracing, that students are *people* before they are *students*. I center this by using people-first language (e.g., *the people in my course*) with colleagues and others. I also constantly strive to understand the things that affect them outside my classroom, and set the norm that we all speak to each other as peers – no matter your role in the course. I choose my language and start classes in a way that seeks to put us on equal footing. That includes using my first name for anyone past their first-year in our undergraduate program, which I do to reduce the perceived power distance by naming everyone as peers and to center learning not hierarchies. Most importantly, when I meet with anyone in office hours or one-on-one, I end that discussion with a check-in on them as a person. This has always helped me stay focused on how I think learning works, and has always brought me personal joy because it is how I want to be treated. But until I heard about it from people like Sierra Houang (one of my undergraduate letter writers), I did not know how much it meant to them.

I use the same approaches in all of my classes to create a specific, trust-building, learning environment. When in class, I make sure to celebrate and appreciate getting something wrong equally as much as getting something right. I also habitualize input and transparency in the function of my courses. I regularly change due dates, course policies, and even assignment expectations based on the feedback I ask for. I do this not to indulge them but as part of teaching them to identify and seek what they need to succeed in learning. That feedback both builds and requires trust – and is bettered by being transparent. Towards that goal, I also call out when I try new things and pre-empt them with specific areas I might want feedback on. In valuing feedback and acting transparently, I role model trust, which I have found is the easiest way to build it.

¹ Specifications grading is an approach to grading that makes every assignment pass fail, is fully transparent about grading criteria, and encourages students to correct and improve their work. <https://www.insidehighered.com/views/2016/01/19/new-ways-grade-more-effectively-essay>

Illustrations of teaching excellence and impact on student learning

To align with the reflective statement above, evidence of teaching excellence and student learning are organized using the same three headings (reflection, context, trust). Organizing evidence in alignment with the reflective statement, as opposed to by course, lets me show how I use the principles in different ways in different courses and align evidence from students to specific things I have done. The headings from the three principles are followed by evidence from other sources independent courses. Those other sources include; scholarly activity related to undergraduate teaching, participation in curricular change projects in the BME department, faculty development work with other GT instructors, other teaching awards, and a summary of CIOS scores from my time at GT.

To start, I would highlight two example comments that refer to all three principles:

- **(CIOS-Instructor best aspect)** *I'm not sure. It's among the list of: understanding that we are human (and college students) first, engaging the class to make a somewhat large lecture seem personal, being an approachable professor, using relevant examples in class, actually creating assignments and projects that didn't make everyone want to scratch their eyes out...there's tons.*
- **(CIOS-Instructor best aspect)** *I cannot emphasize this enough: Todd is one of the best (if not the best) professor I have had at Georgia Tech in my 3 years here. I was nervous going into this class because I assumed that statistics would be difficult for me and not interesting. Todd literally changed my view not only of my education, but myself. He teaches in a way that I wish every professor would with a focus on learning and growth. Knowing that I would not be penalized for making mistakes on the homework helped me to be able to determine if I knew the material or I just thought I did. I loved the emphasis he put on real world application and how he related things back to BME constantly. It really helped me to stay interested. The tests were challenging but fair, and I think they were an accurate representation of what we learned. I think I have retained a lot more of what I have learned from this class than other classes, and I firmly believe this occurred because of the set up of this class. The most helpful thing for me was the review of old problems we had to do every week on the homework. It really helped me to understand my mistakes, but it did so in a way that was not intimidating or shaming. I have had experiences in other classes where I felt embarrassed and ashamed to be wrong. I never felt that way in this class. Instead, I felt encouraged to try again if I made mistakes the first time, and I felt safe to learn. Todd taught with empathy and compassion in a time when many people need it more than ever. I know that times are difficult for many people right now, and in some ways the response from GT has been lacking. I felt genuinely that I could talk to Todd if I needed help with something, and I always felt encouraged that someone believed in me. I am always going to be grateful for his impact on my life. He has really reignited my passion for learning that I lost for a while after going through some difficult times.*

Structure and reward reflection

Examples from the development of BMED1000 – Introduction to Biomedical Engineering

- I led the development of BMED1000 (Introduction to Biomedical Engineering). The course is built around repeated cycles of *explore and reflect* to help students discover biomedical engineering. That model helps students learn about the diversity of opportunities in Biomedical Engineering and build agency over their growth at GT. In each assignment, students are asked to take an action to explore their new field, and then reflect on what they learned from that exploration. Examples include:
 - Students work in groups in class, and then individually after class to define engineering / biomedical engineering and then discuss with classmates their individual definitions and paths to our department and field.

- Students interviewed junior and seniors in their majors about their path, experience, and goals. They then used this information to build a plan for their time at GT.
- Students had to self-organize a tour of a BME research lab. Each student had to contribute a one-page summary to a collaboratively curated book about research done by BME faculty.

Examples of student comments highlighting these efforts and their connection to learning:

- *Though my time in BME 1000 has come to an end, I will carry the lessons I have learned with me as I continue to design a life for myself here at Tech. I arrived at this school timid and shy, afraid of rejection and frozen in a state of inaction, but going forward, I will be my own advocate. Every action I take, no matter how embarrassing or disastrous it may seem, will create value, for it is in pushing myself that I grow. I will go to career fairs, apply for internships, interview for lab positions, even when I know I may not get selected. I will continue learning, continue making connections, and I resolve to do so unapologetically. Tech is my home now. I belong here, and I intend to take advantage of all the opportunities on offer.²*
- *My time in BMED1000 has also been really critical for my development as an engineer even in this first month. Before this class, I did not fully understand what engineering entailed, all of the work that went into making the most basic prototype, and the amount of reflection necessary throughout the process. Perhaps one of my most important accomplishments so far is the development of [a]n entrepreneurial mindset which allows me to use my curiosity to find and establish connections that will allow me to create value for myself.*
- *It taught me more about myself than I ever thought I would learn in this class. I came in thinking it was more about my career, but it incorporated my own goals and beliefs that made me think more about if I loved what I was doing rather than would I be successful in what I was doing.*

Examples of introducing reflection in BMED2400 – Introduction to BME Statistics

- As described in the reflective statement, I have worked over multiple semester to develop homework with a strong reflective component. Examples of reflection in statistics homework include:
 - Explicitly encouraging collaboration and asking students to report any things they helped peers learn or that peers helped them learn as part of collaborating
 - Use real data collected by students to encourage students to reflect on data quality and the credibility of the inferences that they make from the data because they know its provenance.

Illustrative example:

Problem 3:

- A) Create a new sheet in the surgical trials spreadsheet titled ‘CLEAN DATA’ and work through each column with a categorical data type so that our data are consistent and ready for analysis (meaning there are no redundant categories).
- B) Explain how you cleaned the data and why cleaning data are important (use at least two examples from the data)

The problem above is from the first homework assignment in statistics. The course is typically students’ first encounter with the realities of messy data, which is critical to a deep understanding of statistics. One the first day of class we do a (messy by design) data collection exercise – the surgical trials spreadsheet mentioned in the problem. For their first

² All italicized text in this section comes from student comments in CIOS or via email and are unedited.

*homework, they have to clean that data. The students find it immensely frustrating and educational. It leaves an impression throughout the course. The image below is of students in groups collecting the data using the board game operation with intentionally vague instructions about how to conduct trials and record the data to increase the likelihood of data being recorded using different guidelines. They are told what to record not how, resulting in many different ways of encoding the success or failure of the surgical trial (e.g., 1/0, yes/no, pass/fail). Students were then asked to work with their cleaned data on every homework and every test. **Please Note: This picture is from Fall of 2019, and the gloves and masks were to build authenticity and engagement not for COVID reasons.***



- For the Summer of 2020, I further redesigned homework to split credit for the assignment into two parts to encourage reflection. The first part of the homework introduced new questions and material. The second part required students to review solutions to previous problems and comment on concepts they misunderstood and how to correct their misunderstandings.
- In statistics, students can also complete test corrections to earn back points that they missed by demonstrating they have mastered the material. That mastery includes explicit reflection on the mistakes that they made, why they were mistakes, and how the correct understanding differs

Examples of student comments highlighting these efforts and their connection to learning:

- *[T]he homework is not just for grades but they facilitate actual learning during completion.*
- *The style of homework was really effective. I especially like that you have to correct your previous homework. If encouraged to, I would probably never look at the solutions. I like the way class is conducted. Since Excel is a really big part of this course, its actually really effective to watch the professors examples online. ...*

- *The homeworks, while long, were helpful in preparing for the exams and did a great job of having us apply the new skills. I also like the opportunity to do test corrections because it would allow me to work to better understand the material and I appreciate that we [had] a week to work on all this.*
- *Such intensive homeworks are necessary to learn and get practice with the material. I especially like that every week we have the opportunity to learn from mistakes on the past assignment and reflect on them. Lectures are generally engaging and encourage participation. Projects are a nice extension of the course, allowing students to branch out in their learning.*

Examples from helping other GT faculty introduce reflection into their courses

- For the BME department's NSF RED (Revolutionizing Engineering Departments) grant, I worked with individual faculty to integrate reflection as a way to improve engagement and build trust
- For the BME KEEN (Kern family Entrepreneurial Engineering Network) grant, I ran a workshop on assessing and providing feedback on reflection
- Since developing the reflective approach to homework in the summer of 2020, I have coached other faculty inside and outside of GT on using the approach and am working on a publication to be submitted in 2021 to the Journal of Statistics Education.

Put engineering in context

Examples from introducing projects in BMED1000 & BMED2400 that bring real context and outcomes

- In BMED1000, I co-developed a project where students reverse engineer biomedical engineering devices that they find in their homes, using an existing tool called the *Engineering Archeology Canvas*³ designed to guide students in the study of everyday engineering objects
- In BMED2400, I had developed and implemented multiple projects that students can pick from in class. These include, evaluating the statistical methods used in a research paper of their choice; identifying, explaining, and proposing a solution to a source of error in the US Census, or creating an exercise with real data to introduce a statistical test we don't cover to their classmates.
- As mentioned earlier, in BMED1000, I built a partnership with The Carter Center where we brought a project from their Guinea Worm Disease eradication efforts into class as a semester long freshman design challenge. The partnership is now extending into planning a second design project related to Polio Vaccine distribution challenges

Examples of student comments highlighting these efforts and their connection to learning:

- *The best feature of this course by far was the design project that we had to do. I felt like this project was extremely helpful in terms of realizing that I actually wanted to be a BME, and I genuinely enjoyed doing it.*
- *I also really liked [the] learning a software feature [project] as it allowed me to explore interesting tools and functions on excel that actually proved very helpful in working out problems from the course.*
- *[The] projects also allowed me to put concepts that I learned together with real-world applications.*
- *I really loved the group project portion of this class. It definitely helped me to get to know other BME students at Tech which was especially helpful ...with the majority of classes being online.*

³ Tranquillo, J. (2015, June), The Product Archaeology Canvas Paper presented at 2015 ASEE Annual Conference & Exposition, Seattle, Washington. 10.18260/p.24902

Examples from consistent use of real world data in BMED2400

In BMED2400, I also introduced student collected and publicly available biomedical engineering data sets to help students better understand the links between real data and statistics. Each data set is used repeatedly throughout class. These data sets include ones that are collected in class to enable discussions about data quality, variability, and the meaning behind data. One student commented:

- *I liked how we stuck with a couple data sets throughout the 10 homework assignments as it allowed me to see all the different types of tests that could be done to yield different conclusions and interpretations.*

Introducing problems based on variation in human size into biomechanics coursework

Outside of my own courses, I mentored instructors in our introduction to biomechanics course (BMED3400) on introducing real data about human size variability into problems in the course. In these problems, different students would be asked to do the same problem using different human sizes as inputs and then compare answers as a class. The variations in size were drawn from real data on anthropomorphic dimensions.

Build a relationship of trust

- **Host office hours in a student space, communicate how to meet with me privately, and generally make students feel valued—in and out of the classroom**
 - *Todd cares an exceptional amount about our wellbeing as people outside of the classroom. I went to office hours twice and he knew my name the rest of the semester which is super impressive. I really felt like he cared about us as people and that really helped make the class enjoyable.*
- **Use a mindset, language, and actions that treats students as people before students.**
 - *Todd cares about his students more than any professor I've ever had at GT. He asks how we're doing, adjusts deadlines if we seem to be having a bad week, is reasonable, accessible, and kind. He actually cares about us as people as well as students and structures his class to focus on learning instead of memorization and test scores.*
 - *Professor Fernandez was very invested in his students as people. On several occasions, he pointed me towards resources or organizations that were related to something I expressed interest in, which shows that he really listened to and cared about what his students said.*
 - *Professor Fernandez cares so much about the quality of our learning and about each student as a whole. He creates a challenging yet unimimidating learning environment.*
- **Show respect for their learning process by being available, positive, and encouraging. This includes celebrating both right and wrong answers and always giving detailed feedback**
 - *I liked the notes and comments that you made on our assignments! I thought they were genuine and really helpful. The course expectations were made very clear through the document, so I had a good idea of what you were looking for in our work. I enjoyed how approachable and responsive you were as well. Overall, you were great!*
 - *The feedback that was offered after each assignment helped me feel that the instructor was truly interested and invested in the students' growth.*
 - *Something that Todd did really well was give great feedback. He emailed every team member comments on our presentations and project reports. He included critiques as well as positive comments. Not only did it help better my skills, it showed me that Todd actually took the time*

to appreciate the time and effort his students put into his class. By giving in depth and well rounded feedback it reciprocated the time and effort we gave him by him giving the same time and effort back. That was greatly appreciated because knowing that he wants to help his students motivated me to try extra hard in the class. I also greatly enjoyed the speakers that he brought in. It helped apply the material in class to the real world because I got to see how people actually go about using the materials and methods we learned about.

- **State my pronouns, and ask students what pronouns they prefer I use in public and private**
 - *Prof. Fernandez was extremely welcoming, and I strongly appreciated his vocal support of the LGBTQ community. Despite not being visibly queer, his efforts to be inclusive were greatly appreciated and made me feel safer in the classroom.*
- **Be transparent about purpose, goals, and expectations by using specifications grading**
 - *The layout of what was expected on each assignment was greatly appreciated. The responses towards each submitted assignment was great and showed me what I either needed to work on or what I already did good on.*
 - *Every assignment had a purpose, and met it well. The way the homeworks were set up to be difficult but still guide you through the problem as you go. The professor cares SO MUCH about the students. He is incredibly approachable and really puts students first*
- **Ask for and implement student feedback throughout class. This includes engaging in democratic classroom policy and schedule setting throughout the course.**
 - *Any improvement I would have suggested Todd addressed before the semester ended.*
 - *I appreciated how Todd adjusted the course based on student feedback and incorporated our feedback throughout the semester.*
 - *The instructors were very responsive to feedback and enthusiastic about course material. They were very accommodating and open about the fact that they were new to this too. They fostered a two-way connection with students and a relaxed classroom environment.*

Other areas of evidence

Scholarly activity related to undergraduate teaching

Note: I do educational research specifically because the results inform my work as an educator. The listings below do not include all of my publications since joining Georgia Tech. Instead, they are specific publications that I have been involved with where the results have impacted my approach to improving my teaching and faculty development work. These publications are one way I learn from and about students.

Journal articles

Brennan, J., **Fernandez, T. M.**, Tranquillo, J. (2021) Professionalization and the forgotten system: Observed practices and perceptions at the intersection of informal and formal faculty development. *To Improve the Academy*. (Under Review)

Fernandez, T. M., LeDoux, J. M., & Behravesh, E. (In Press), Near-real learner analysis and faculty support during a transition to online education. *Biomedical Engineering Education*

Exter, M. E., Gray, C. M., & **Fernandez, T. M.** (2020). Conceptions of design by transdisciplinary educators: disciplinary background and pedagogical engagement. *International Journal of Technology and Design Education*, 30(4), 777-798.

- Gray, C. M., & **Fernandez, T. M.** (2018). When world (view) s collide: Contested epistemologies and ontologies in transdisciplinary education. *The International journal of engineering education*, 34(2), 574-589.
- Douglas, K. A., **Fernandez, T. M.**, Purzer, S., Fosmire, M., & Van Epps, A. (2018). The Critical-Thinking Engineering Information Literacy Test (CELT): A validation study for fair use among diverse students. *The International journal of engineering education*, 34(4), 1347-1362.
- Exter, M., Caskurlu, S., & **Fernandez, T.** (2018). Comparing computing professionals' perceptions of importance of skills and knowledge on the job and coverage in undergraduate experiences. *ACM Transactions on Computing Education (TOCE)*, 18(4), 1-29.

Conference publications and presentations since joining Georgia Tech

- Fernandez, T. M.**, Martin, K. M., & Mangum, R. T. (2021, July), *Work-in-progress: Comparing students' perception of the justice and fairness of traditional and specifications grading in a capstone course*. Paper submitted to the 2021 ASEE Annual Conference (Submitted)
- Morgan, K. L., Bernardo, A., & **Fernandez, T. M.** (2021, July), *Gender and human imagery in the halls of a BME department*. Paper submitted to the 2021 ASEE Annual Conference (Submitted)
- Bell-Huff, C. L., **Fernandez, T. M.**, Morgan, K. L., Benkeser, P., & LeDoux, J. M. (2020, June), *A Vertically Integrated Portfolio Process to Foster Entrepreneurial Mindset Within an Undergraduate Biomedical Engineering Curriculum* Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line . 10.18260/1-2--34081
- Fernandez, T. M.**, Bell-Huff, C. l., Morgan, K. L., & LeDoux, J. M. (2019, June), *WIP: How Students Externalize Epistemologies: Describing How Students Explain, Ground, and Consciously Construct Their Definitions of Engineering and Biomedical Engineering* Paper presented at 2019 ASEE Annual Conference & Exposition, Tampa, Florida. 10.18260/1-2—33563
- Fernandez, T. M.**, Brennan, J., & Tranquillo, J. (2019, June), *Guerrilla Faculty Development: Roles, Methods, Skills, and Needs for Informal Faculty Development in Engineering Departments*. Workshop facilitated at 2019 ASEE Annual Conference & Exposition , Tampa, Florida.

Faculty development work to assist other instructors and the BME department

Mentoring other individual faculty members

- I worked with David Torello, an Administrative Professional in the Mechanical Engineering Department, to revise the assignments and grading system in his dynamics course in Fall 2020
- I co-facilitated a course redesign team to help two pre-tenure BME faculty introduce design, team problem solving, and a set of diversity and inclusion exercises into BMED3400 (Introduction to Biomechanics) during from the Summer of 2018 through the Spring of 2019
- I am mentoring Dr. Hannah Song in introduction reflection and engineering design into BMED3100 (Systems Physiology) during the Fall of 2020 and continuing in the spring of 2021

Faculty development work in the GT BME department

- During the COVID-19 transition to online education in the Spring of 2019, I developed and facilitated numerous faculty development programs in the BME department to support instructors. Including:
 - A virtual workshop on effective, equitable, and trustworthy online assessment
 - Aided the BME department in developing student and faculty messaging

- Developed and implemented a system to provide ongoing course and educational feedback for all BME courses, see publication in the journal *Biomedical Engineering Education*, that provided twice weekly student feedback to all faculty on the experience of learning during COVID and actionable ways to adjust classes to support students
- Held office hours for BME faculty transitioning their courses to online throughout Spring of 2020.
- Coordinated between OIT and BME to help faculty understand and implement information technology guidance in their online classrooms
- Hosted multiple workshops for faculty across the department to share innovative educational techniques and educational research findings
 - Alternative approaches to grading in engineering courses
January of 2019, attended by 12 BME faculty
 - How to use and assess reflection in engineering courses
Hosted multiple times and has been attended by ~20 BME faculty
 - Actions to optimize the first 5 minutes of class to engage students in learning
November 2018 BME Faculty Meeting

General Table of CIOS scores from my courses

Course	Semester	Respect	Effectiveness	COE Median
BMED1000 (9 sections, 214 students, hybrid, co-taught)	Fall 2020	4.87	4.85	4.31
BMED2400 (1 section, 43 students, online)	Summer 2020	5.00	4.94	4.76
BMED1000 (3 sections, 94 students)	Spring 2020	-----N/A – COVID-----		
BMED1000 (6 sections, 220 students, co-taught)	Fall 2019	4.68	4.43	4.60
BMED2400 (1 section, 90 students, co-taught)	Fall 2019	4.91	4.79	4.50
BMED1000 (1 section, 12 students)	Spring 2019	5.00	5.00	4.80
BMED2400 (1 sections, 73 students)	Spring 2019	4.97	4.78	4.50
BMED1000 (3 sections, 57 students)	Fall 2018	4.94	4.81	4.50

Note: Values from interpolated median values in smart evals

Letter of support from a colleague



Wallace H. Coulter Department of
Biomedical Engineering



EMORY
UNIVERSITY

January 28, 2021

Members of the Awards Selection Committee:

It is my pleasure to write this letter of recommendation on behalf of my colleague Todd Fernandez. I have known Todd since August of 2018. We began our faculty appointments at Georgia Tech together at that time. Todd and I were both hired to teach and help lead the large-scale curricular innovation efforts within the BME department because of our unique engineering and education training. Todd is an integral part of our Studio for Transforming Engineering Learning and Research (STELAR). This unique team is embedded in our BME department and consists of engineers, social scientists, and educators collaborating to make learning and research more inclusive and more relevant to addressing real human needs. As part of this group, Todd has been a thought leader in the scholarship of teaching and learning.

Since coming to Georgia Tech, I have collaborated with Todd on a variety of course development, curricular change, scholarly research, and course teaching activities. In fact, we have spent the last two and a half years developing the new, required *BMED1000 Introduction to Biomedical Engineering* course, co-teaching that course, and working to improve the BME curriculum. As such I have witnessed first-hand his outstanding leadership, project management, and curriculum development abilities. However, Todd truly shines in his abilities as an educator and student advocate. In the classroom, Todd does an extraordinary job of building relationships with his students. He works hard to create a positive classroom environment, communicate expectations clearly, and demonstrate care and respect for all of his students. Todd does an excellent job of connecting his professional experiences as an engineer to the actual content of any class he is teaching. By doing so, he is able to inspire students as to the importance and relevance of course topics for the practicing engineer.

Todd typically teaches both *BMED1000 Introduction to Biomedical Engineering* and *BMED2400 Introduction to Biomedical Engineering Statistics*. It is important to note that these courses are very different in the course content, pedagogy, and instructor skill required. In *BMED1000*, the instructor must create an environment to help new students adapt to life at Georgia Tech and become part of the GT BME community, while at the same time teaching topics such as design thinking, reflection, and entrepreneurial mindset as important engineering skills. On the other hand, *BMED2400* is a core course in the BME curriculum that requires deep technical knowledge and pedagogical skill. Todd has been able to succeed in both of these course environments. In fact, Todd has worked hard to make changes in the *BMED2400* class in order to make it more active, collaborative, and inquiry-based. Since I shared an office with Todd at the time, I saw the impact, increased student learning, and improved student experience that happened as he implemented changes in this course. Students visiting during office hours were highly engaged and interested in understanding the material they saw as extremely relevant to their future careers. In his one-on-one interactions with students during office hours, I have seen Todd wear many hats such as teacher, coach, career advisor, counselor, and fierce student advocate. He has done so with great empathy and care. Indeed, we are fortunate to have Todd as part of our BME faculty and I believe he is highly deserving of this award.

Please feel free to let me know if you have questions or would like to discuss anything further.

Sincerely,

Cristi Bell-Huff, PhD
Lecturer, Director of Faculty and Student Training
Wallace H. Coulter Department of Biomedical Engineering
cristi.bell-huff@bme.gatech.edu

Letters of support from undergraduate students*Ms. Rachael Chidinma Onyewuenyi – BME Class of 2022*

To whom it may concern,

It is my pleasure to write a letter of support on behalf of Professor Todd Fernandez's nomination for the Georgia Tech Undergraduate Educator Award. Professor Fernandez has played a pivotal role in my development as a student and as a person at Georgia Tech. I was fortunate enough to take courses with him in both BMED 1000 Intro to Biomedical Engineering and BMED 2400 Intro-Bioengineering Statistics. In both courses he personally took time to ensure my success as a developing engineer.

In Professor Fernandez's courses, he always makes it a strong point to see every student as a person first, then an engineer in the making. As a student, that is a characteristic that makes Professor Fernandez stand out in an immensely meaningful way. I know many students, including myself who have gone out of their way or built a less than ideal schedule to ensure they have Professor Fernandez for specific courses. Our choice to do so is because of both his effectiveness as an instructor and also his caring nature as a person. Professor Fernandez's courses are also taught in a way that ensures applicability to real-life situations. He takes the time to introduce connections to real engineering through homework assignments, projects, and even extra credit work opportunities. When I took BMED 2400 Bioengineering Statistics the assignments were set up in a way that students were not only learning the new material but also taking time to reflect on older content to check that they really understood it. Every homework assignment was accompanied by a reflection about the previous homework assignment where each student is given a chance to self-evaluate how their understanding of each concept had grown or was still lacking. This is a strategy that I've never seen in other courses but is always consistent in Professor Fernandez's. This is due to the consistent idea of an "engineering process" he has taught me applies to every Biomedical Course. The courses that I've taken with Professor Fernandez have given me a chance to broaden my ideas of what I believed an engineer looked like. In BMED 2400, there were times we had professional guests come and apply the actual techniques we were learning in class to their real-world profession. This made it seem as though our lessons in the class were genuinely preparing us for our future as engineers.

There are plenty of examples where I believe Professor Fernandez has gone above and beyond as a Georgia Tech professor. In recent semesters, there have been times where I have been personally emotionally overwhelmed and stressed about life or school and Professor Fernandez not only provided emotional support but ensured that these events would not jeopardize my learning experience. It takes a great professor to recognize that unpredictable circumstances should not ruin the chances for great learning opportunities. Todd Fernandez is a professor who cares for his students and genuinely wants to see everyone succeed. This is why I can confidently say this award is well deserved and earned. He has gone out his way personally to discuss my experiences as an African American woman in a white male dominated field and after doing so he not only listened, but he acted. He proceeded to create a seminar for faculty members in BME about Black, BIPOC, and LGBTQ students' experiences. He sought to give us a platform to share our stories with the Biomedical Engineering faculty. At this event, the faculty discussed specific stories about marginalizing or exclusionary experiences and the role that faculty can now play in preventing them. He started a conversation that was long overdue and greatly needed. This showed me that Professor Fernandez understood the importance of creating a learning environment where all students could feel confident and comfortable enough to succeed academically. He is an honest ally for minority students and words cannot express how much we value his advocacy for our needs.

If you have any other questions, please don't hesitate to contact me.

Rachael Chidinma Onyewuenyi
Biomedical Engineering '22
Georgia Institute of Technology

Ms. Maite Marin-Mera – BME Class of 2020

February, 2021

To Whom it May Concern,

I would like to recommend professor Todd Fernandez for the Undergraduate Educator Award because of his deep passion for education, his willingness to innovate, and the way he listens to his students. I have had the fortune of knowing Professor Fernandez through multiple different experiences including taking his course on statistics, BMED 2400 and participating on the BME department's Committee on Community, Diversity, and Inclusion (CD&I).

It was in our first BMED 2400 class that my fellow students and I found out how much thought and care Professor Fernandez had placed in designing his course. The homework and reflection components were designed to deepen our understanding of statistics concepts through real life scenarios. Professor Fernandez used the homeworks as reflections of our learning and retaught the concepts we struggled with in class, ensuring our understanding before moving on. He was accessible to all students, even those who were not performing well in the class. In office hours, he encouraged students to work together, helping develop a sense of community in his course. This community and his emphasis that our grades were not dependent on other students grades helped foster collaboration instead of competition in the classroom.

I was fortunate to also see the intentionality Professor Fernandez brought to designing and helping change the curriculum for other BME courses through my involvement in CD&I. Professor Fernandez strove to consider how all changes would impact multiple diverse student populations. When we were reviewing syllabi, it was Professor Fernandez who broached the topics of including preferred pronouns and having personalized statements on what students should do if they need support. Professor Fernandez is unafraid of innovating in the classroom, willing to try new techniques, and following up with students to identify areas for continued growth. I believe the introduction course, BME 1000, is an excellent example of his educational innovation and passion for teaching and learning as he developed the course with insight from students themselves on what they would have wanted to know as an entering BME student. His class design is unique in that it is very student driven, reflective, and allows for students to imagine futures beyond what a traditional engineering path can be.

I believe that Professor Fernandez's largest impact on students and the department is his ability to incorporate outreach and insight from beyond the classroom and laboratory to broaden what it means to be an engineer. I have felt this impact tremendously, as I always felt I was not destined to be a traditional engineer but did not know what other opportunities there were. It was Professor Fernandez who listened to my experiences, asked probing questions, provided me with books and articles to read, and was willing to broaden my understanding so I could make a more educated decision for my future. I would not be going into consulting if it was not for Professor Fernandez's guidance and willingness to listen. It is clear to me that Professor Fernandez is willing to help many other students in the same way and contributes to Georgia Tech by supporting and uplifting its students.

Due to Professor Todd Fernandez's clear passion for education and his willingness to go above and beyond for all of his students, I believe he would be a wonderful recipient for the Undergraduate Educator Award. Please feel free to contact me at my email to expand on any of the thoughts above or answer any questions.

Sincerely,

Maité Marin-Mera

5th Year Biomedical Engineering Student, Fall 2020 Graduate

Ms. Sierra Houang – BME Class of 2022

To Whom It May Concern,

What makes a truly exceptional educator? To find the answer, look at Professor Todd Fernandez. Regrettably, most of my interaction with Professor Fernandez has been remote, but even so, it is inescapably clear to me that he is a once-in-a-lifetime professor whose passion for education, engineering, and the wellbeing of his students goes above and beyond the call of duty.

The first class I took with Professor Fernandez was Intro to Bioengineering Statistics (BMED 2400) in the summer of 2020. Professors had only had three months of experience teaching in a global pandemic, yet from the start, Professor Fernandez conducted his class with organization, transparency, and compassion. Despite the numerous and unrelenting complications, he provided us with a detailed syllabus outlining exactly what “asynchronous” and “remote” meant, where the lectures would be held, and how to turn in assignments. During lectures, Professor Fernandez embraced the clunkiness of the online classroom and powered through it. He was unafraid to ask the students questions and would let us marinate in awkward silences until we answered. By the second or third class, the Microsoft Teams channel was bustling with comments, questions, and reactions to the learning material. In assuring us that he would not let his students become passive learners under his watch, Professor Fernandez created what has been the most interactive online learning experience I have ever had. In this way, Professor Fernandez has proven his affinity for educational innovation.

He has not only done so in the face of the COVID-19 pandemic but also in response to an age where pretty much everything is Google-able. Professor Fernandez’s dynamic approach to homework forces students to think for themselves and actively reflect on their performance. The questions are not focused on finding the right answer. They are about applying a statistical mindset and a problem-solving process. Furthermore, each homework requires you to reflect on the previous week’s responses, creating a continuous cycle of application and contemplation.

As Professor Fernandez bluntly summarized on the first day, “The internet will not help you with my homework. You will not be able to find answers on Chegg. Uploading the homework is a violation of the Academic Honor Code, but also you guys are smarter than the people at Chegg. They won’t be able to answer these questions.”

I have never had academic integrity framed in this way: where it didn’t make sense to cheat, not only because it was unethical, but also because I was more capable than the people on the internet. Professor Fernandez operates his whole teaching philosophy in this manner, building his expectations of his students around his belief that we are trustworthy, smart, and hardworking until proven otherwise. I must confess, I do not always see myself this way, but Professor Fernandez’s unwavering confidence that I am this person makes me want to live up to that expectation and deserve such high regard.

Professor Fernandez approaches his student as human beings first. During the summer, my entire immediate family contracted COVID-19, and I was forced to find a new living situation, be my family’s link to the outside world, and deal with the stress and worry that comes with having loved ones in danger. I went to Professor Fernandez asking for an assignment extension, and he granted it to me but also asked if I was okay, had a place to go, and had food to eat. In a moment of complete crisis, his consideration, empathy, and respect lifted so much weight from my shoulders and allowed me to reengage with my education without fear of failure or judgment. This was not the last time I benefitted from Professor Fernandez’s compassion.

Last semester, I struggled ruthlessly against my own mind. Amidst the stress of my first full semester at Georgia Tech, the deeply dissatisfying nature of online education, and the death of my grandfather, I began to ask “What’s even the point?” so often that it felt like a physical weight on my body. The question sat on my chest when I tried to get out of bed, stuck in my throat when I tried to eat, and pulled

me away from my loved ones when they tried to reach out. I convinced myself that I would grapple with this question when I had less schoolwork; when I wasn't so busy. It was in the middle of this downward spiral that Professor Fernandez filled in unexpectedly for one of my in-person courses. After class, he asked me how I was doing, and I replied unconvincingly that I was hanging in there. He looked directly at me and asked, "Are you okay?"

I didn't really have an answer to that, so I just nodded. He didn't let it go. He told me that he was worried about me and insisted that people do not fail out of this program because they do too little but rather because they try to do too much. I left the classroom fighting tears. Professor Fernandez had no idea what I was going through, yet he had shown me a level of care that, at that moment, I could not show myself. It was utterly overwhelming, but that conversation gave me the permission I needed to let go of my ego and imposter syndrome and focus on my mental health.

Professor Fernandez is great at teaching, but it is his capacity to truly invest himself in his students' education and well-being that makes him an outstanding educator. I recommend Professor Todd Fernandez for the Undergraduate Educator Award with the highest regard and deepest conviction.

Sincerely,

Sierra Houang

B.S. Biomedical Engineering
Georgia Institute of Technology '22