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Application Summary

Competition Details

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Application Information

Submitted By:	Richard Simmons
Application ID:	9854
Application Title:	Richard Simmons
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Personal Details

Applicant First Name:	Richard
Applicant Last Name:	Simmons
Email Address:	richard.simmons@me.gatech.edu
Phone Number:	(404) 385-6326

Primary School or Department
Mechanical Engineering & Strategic Energy Institute

Primary Appointment Title:	Principal Research Engineer

Application Details

Proposal Title
Richard Simmons

Richard A. Simmons, Ph.D., P.E.
2023 Innovation and Excellence in Laboratory Instruction Award Nomination
February 2023

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Georgia Tech College of Engineering
George W. Woodruff School of Mechanical Engineering
Devesh Ranjan, Eugene C. Gwaltney, Jr. School Chair and Professor

February 5, 2023

Dear CTL Awards Selection Committee,

It is my pleasure to nominate Dr. Rich Simmons for the CTL Innovation and Excellence in Laboratory Instruction Award based on his exemplary contributions to experiential learning at Georgia Tech. Rich leverages his non-traditional background to bring the world into our laboratories, and our laboratories out to the world.

Rich complements our faculty extremely well because his career path includes 15 years in industry, 3 years in service to the federal government, and 12 years in academia… a total of 30 years of diverse "laboratory immersion." Rich has conducted R&D and design in the automotive sector. In his lab classes, he now conducts unconventional experiments on everyday products to convey design principles. He holds multiple patents and is therefore equipped to explain intellectual property to Georgia Tech's aspiring inventors. He has been a licensed Professional Engineer for 20 years, thus able to relate coursework to students seeking a similar path. He served a AAAS Science and Technology Policy fellowship at the U.S. Department of State, and can teach our students how technology and economics must adapt to serve people and societal needs around the world. Rich earned a mid-career PhD in focused on clean energy systems, an area of growing interest where Georgia Tech students will undoubtedly leave their mark.

Dr. Simmons is himself a product of the GWW School, having graduated with honors in BSME in 1993. His personal history with the School of ME and the Institute enhances his ability to connect at a personal level with students.

Two of the courses in the ME curriculum our students consider among their most formative and memorable (as reflected by survey data and popular opinion) are laboratory-oriented project classes entitled: ME2110- Creative Decisions and Design; and ME4182 Senior Capstone Design. Rich has spent the last seven years helping pioneer new approaches that are making these courses even more relevant and valuable to our graduates and their future employers. His contributions infuse a focus on energy and sustainability with awareness toward economic viability, and orient students so they can envision solving global grand challenges. He has developed excellent rubrics used to assess technical writing skills and oral presentations. Whether instructing in a lecture hall of 200 students, a lab studio of 25, or with a project team of 6, Rich engages his audience, encourages critical thinking, creative inquiry and investigation. He has had great success creating a lab environment where students are surprised and delighted to realize how much they can learn from each other and expect from themselves. The GWW School has risen in the

ranks to #2 in undergraduate education for Mechanical Engineering because of commitment to students and creative, continuous improvement by a team of faculty that includes pragmatic engineers like Rich.

Rich has a primary appointment as Principal Research Engineer with the Georgia Tech Strategic Energy Institute, and a courtesy appointment in the School of Public Policy. As a research faculty member, he is not obligated to instruct, but our school is better because he does. Since starting in 2016, Rich has been the primary instructor for 17 formal ME lab-oriented courses, nearly 400 students combined. He has consistently earned impressive CIOS scores: 4.9/5.0 overall teaching effectiveness. He also received CIOS teaching awards in 2017 and 2019, and the CIOS honor roll in 2021.

Anonymous student comments reveal him to be a gifted educator, able to explain engineering concepts via real-world examples and, physical demonstrations. Rich Simmons relates to students where they are, inspires them to set ambitious goals, and then equips them with tools and knowledge to surpass those goals. Students repeatedly express appreciation for his clarity, valuable feedback, availability, compassion, enthusiasm, wit and depth of knowledge. As School Chair, it is wonderful to see quantitative evidence of effective teaching, and to hear so many inspiring comments in students' own words.

In 2022, Dr. Kyriaki Kalaizidou and I invited Rich to participate in the GWW Academic Leadership and Management Fellows Program. Rich joined a cohort of a dozen or so tenure track and research faculty in a 12 week program aimed at fostering a lab culture of excellence and providing tools to enhance research and educational experiences for faculty and their students. Each participant developed a self-defined focus project over the course of the semester. Rich's project was entitled, "Enhancing connections between GT research faculty and undergraduate students." Two important gaps motivated Rich's project: (1) students are often unaware of activities being pursued by non tenure track faculty; and (2) research faculty often lack a forum for interacting with undergraduate students. By virtue of Rich's part-time instructional duties, he was able to draw on best practices and develop valuable recommendations which he is implementing himself, and helping us scale up today. These include more explicit mechanisms for facilitating such interactions, info sharing, promotion of part-time undergraduate research opportunities for credit or pay, and a more standardized protocol for supporting students with Letters of Recommendation and career advice. Rich explained that he has written more than 40 letters of recommendation over a seven year period, and arranged countless informal sessions to discuss academic and career pathways. While some students may seek to pursue an advanced degree, many will begin a satisfying career immediately following graduation. Rich noted that first-hand advice and letters from Professional Engineers can be extremely valuable in a competitive job market.

Rich has helped architect a number of special problems courses (ME4699, 8931) and has sponsored students conducting PURA projects. He is equally comfortable instructing K12 STEM students, as he is PhD students. As evidence for this, Rich created an entire summer camp curriculum, entitled "Energy Unplugged." Rich hires undergraduate and graduate students to help administer lab demos and counsel high school students, which gives

learners and counselors exposure to experiential teaching. Rich has also produced a video short course (mini-MOOC) entitled, “Energy 101: Southeast.” It was filmed with support from students in GT’s School of Literature Media and Communications, and built around resources and research co-developed by Dr. Simmons and undergrad students. Lab experiments, fundamental engineering concepts, and a sense of humor feature heavily in both the summer camp and video series.

Finally, Rich brings unique tools, perspectives and experiences into our labs, and shares that insight to help equip a new generation of graduates. Graduates who understand not only theory, and not only practice, but the needs of human beings and society as well. Rich’s lab instruction has been of the highest caliber. His enthusiasm and learner-oriented mindset are among his greatest interpersonal assets. Rich is the kind of instructor that makes School Chairs very proud, and he represents Georgia Tech exceedingly well. As a result, I am pleased to provide my highest possible endorsement of Dr. Rich Simmons for the 2023 Innovation and Excellence in Laboratory Instruction Award.

Sincerely,

Devesh Ranjan

Devesh Ranjan (he/him/his)
Eugene C. Gwaltney, Jr. School Chair and Professor
Tel: 404-894-3201 | Email: devesh.ranjan@me.gatech.edu

Executive Summary

Dr. Rich Simmons is a natural educator and has a unique ability to make the world come to life in the laboratory. As a lifelong learner and GT alumnus, himself, Rich is adept at seeing the world through the eyes of his audience, regardless of their age or educational background. He has instructed upwards of 400 students in formal Mechanical Engineering lab settings. It should be noted that while these laboratory courses comply with rigorous standards, they are not cookbook style and are never the same twice! Rich is constantly iterating and improving the lab experience, whether that means identifying diverse student strengths to nucleate teams with complementary skillsets, integrating feedback from students and fellow instructors to upgrade content, or beginning class with a demonstration to teach key concepts. Rich has shared his tools and best practices with peer instructors and administrators to consistently enhance the quality of two signature experiential lab courses in engineering.

The evidence of his impact can also been seen through earned teaching awards and honors (2017, 2019, 2021), and quantitative instruments like CIOS. Since 2016, Dr. Simmons has earned a cumulative CIOS instructor rating of 4.9/5.0 (based on 245 unique respondents). Through anonymous comments, students consistently affirm Dr. Simmons's enthusiasm, respect, inclusivity and clarity in the lab. Students highlight his creative, fun and experiential approach that investigates real-world examples and applies them to formal coursework via experiments, analysis and critical thinking.

In prioritizing student needs, Rich has identified opportunities for formally enhancing the way research faculty can support undergraduates as they explore career opportunities. Rich is approachable and has an open door policy that is complemented by the extended-hour, outside-the-box environment of learning-by-doing labs. He has thus met one-on-one with countless students that want to know what it's like to work in industry…or government…or a university research lab. His diverse background has positioned him to provide insight and guidance, letters of recommendation, resources, contacts, and part-time employment opportunities for students.

Rich's understanding of the "laboratory" is broad and inclusive. He leverages his lab experience, research appointment, and non-traditional background to open the eyes of students to the intersection of technology and the world. For example, he has pioneered "Energy Unplugged," a STEM summer program that has become one of CEISMC's more popular camps and is filled with hands-on demos, field trips and experiments to inspire students toward degrees and careers in STEM. Rich is also active producing online courses, engaging videos and convening town-hall meetings for general audiences, mid-career professionals, and elected officials alike. He always includes students in this process: to contribute, but also to learn about teaching. These public resources are extremely popular and demonstrate how Georgia Tech can reach a wider external audience with experiential learning approaches that originate in formal laboratory settings.

Introduction

Experiential learning is foundational to most undergraduate degrees, and is particularly catalyzing for students earning STEM degrees. At the same time, universities like Georgia Tech

have achieved success and top rankings by consistently delivering rigorous instruction and research built upon underlying theory and science. Given high standards and increasing pressure to streamline the curriculum, it has never been more important to make no compromises in integrating theory with laboratory experiments and open, inclusive ideation. Good problem solving depends on this, future employers value it, and the world has never needed it more.

Dr. Rich Simmons understands this complex reality. In part, because he was a Georgia Tech student during a different era when instruction was undoubtedly excellent, but there was comparatively limited interaction between faculty and undergraduate students. Conversations outside of HW/exam prep were rare. Technical writing and public speaking were required, but as separate courses, their connections to engineering course content was relatively superficial. Labs were hands-on and fun, but not always well-contextualized. There was no CIOS. Assessment instruments that involved students were limited, as were resources for career guidance. In defense of both students and faculty of the era, a forum for the exchange of ideas or suggestions for improvement had not yet been standardized. Great credit is due to institute leadership and faculty for the progress made on this front in 30 years, as the merits of feedback and closer interaction are more fully appreciated. Dr. Rich Simmons believes our laboratories can serve as a front-line secret weapon to push even further, and has made key innovations accordingly.

Another reason Rich relates to emerging opportunities that leverage our labs derives from career experiences in industry and the Federal government. Rich developed his own approaches for tackling real-world engineering problems in his own career, which enables him to connect theory and practice quite explicitly, and treat each student like the engineer they will one day become.

This document presents quantitative, qualitative and anecdotal evidence of Rich's teaching impact over 17 semesters and across two formal laboratory-based courses in Mechanical Engineering. It demonstrates how he invests in students more broadly, to offer career advice, to mentor, and to inspire students to explore teaching and research. It touches on his role creating a series of STEM experiments for use in a GT administered summer program. It also discusses an online video short course, in which Rich applies insights gleaned from his formal instructional labs. Finally, it mentions how Rich is paying it forward to institutionalize and scale best practices, while challenging convention to envision what might come next.

Key Contributions and Innovations

Dr. Rich Simmons has made a number of impactful contributions during his time instructing Mechanical Engineering labs at Georgia Tech, and students are the ultimate beneficiaries. At the same time, Rich has helped improve the curriculum, via standardization and implementation of best practices among his fellow faculty and departmental administrators. Following are some key examples of Rich's innovative contributions in Creative Designs and Design (ME2110) and Senior Capstone Design (ME4182/4723). These are loosely divided into categories, whereas there is an emphasis on the compound effects:

Technical competency through experiential learning:

- An *integrated* focus on:

    - scientific and engineering first principles and fundamentals,
    - ideation, and
    - the merit of well-developed prototypes and experimental inquiries;
- Student aptitude to identify mission critical factors, while allowing flexibility to accommodate creativity and individual approaches to solutions;
- Hands-on examples and demonstrations from real-world engineering problems to convey core design concepts and course objectives;
- Guest lectures on energy and sustainability as case studies for the design process.

Novel resources that you won't find in a book or online:

- Unique lab resources with tools and advice for current students, based on:
    - instructor's experiences, and equally importantly,
    - documented written experiences of prior students,
    - oral personal experiences of prior students, presented live in class;
- Customized rubrics and feedback to enhance technical writing and presentation skills;
- Formal course improvements (e.g., big competition/expo, student workload and time management, textbook adaptations, new resources, TA development, etc.);
- Career advice and letters of recommendation for students.

Collaborative learning, morale and approachability:

- An open and respectful laboratory environment where students are free to dialogue, challenge and learn from one another;
- Being available and responsive to students, considerate of personal situations, but also fair and consistent with course expectations and policies;
- Specialized approaches to team formation to leverage individual capabilities and optimize collaboration and team chemistry;
- Quick, informal, no-credit, low-risk classroom challenge contests to stimulate thinking on core objectives;
- Coaching, mentoring and schedule management during heavy workloads;
- Fun, end-of-term superlatives for notable team achievements and successes.

Evidence of Impact across multiple Laboratory Initiatives

ME2110: Creative Decisions and Design

This required laboratory course is a student favorite, but also extremely demanding. It is usually taken by second and third year ME students, but is also open to other majors. The following concepts, though not at all exhaustive, illustrate how Rich presents analogies and examples to meet learning objectives, build an inviting lab environment, and open new channels of discovery.

Trade-off analysis. During the first laboratory studio of the semester, Dr. Simmons often begins with the following statement: "During college, there is a saying that there are three things student seek:

- good grades,
- a social life, and
- sleep...

Figure 1 College Trade-Offs

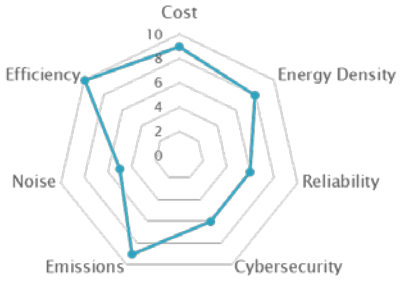
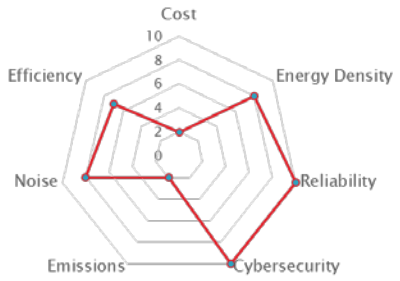
“But the catch is, you will have to choose two out of the three!”

Trade-offs are a real part of life. And this is no less true in the lab… or product design, or business, or government policy-making. Immediately, we can view this particular lab, ME2110, as a window into the world. This is no longer a course about mechatronics with a design competition at the end. This is preparation for life itself.

The introduction to trade-offs is often followed by roll call and a subtle ice breaker. As students introduce themselves they are asked to share about a major purchase they have recently made, in which they had to consider their priorities in context. Example answers often include: cell phones, laptops, trips, espresso machines, skateboards, furniture, and cars. Among these items, students are asked a few questions: What features are most important? What is my budget? Does weight matter? What about aesthetics? Durability? Am I willing to compromise on efficiency for performance?

Customer needs and decision-making. The table is set for a critical discussion about product characteristics and the audience (or market) for the products and services people buy. Students may not be conscious of just how many analyses and trade-off decisions they make every day, in their heads. The very decision to attend Georgia Tech is one such example, but they may not have previously related to this as a process that can be formally structured and applied to engineering design. Table 1. depicts radar plots that show how two very different clients-- the Department of Energy and the Department of Defense, may value various objectives for an energy generator that provides electricity. Each characteristic carries a weight of 0-10, with 10 being “most important.” Students can easily see that one size does not fit all in generator design, and that we must consider that the customer is a major factor in developing an effective design.

Table 1. Radar plots showing generator attribute weightings by different customers (DOE vs DoD)

Department of Energy Generator	Department of Defense Generator
	

This establishes an excellent platform for students to approach decisions within the class, and in preparation for much more important decisions in life. As students experiment with spaghetti towers held together with tape, catapults that minimize material usage, they then begin to design, code and fabricate their robotic devices to accomplish assigned tasks. But they do so with a framework that allows them to rigorously evaluate trade-offs, customer needs and decisions.

The best tool for the job. As students grapple with one of their first “open-ended” project assignments to construct a robot, they are provided a kit of mechatronics components and given training on their operation. Rich builds upon his fundamental training to challenge them to consider structured ways of matching an appropriate actuator with an intended objective. For instance, their motors act precisely but slowly, whereas a falling weight, a closing mousetrap, or

an air actuated cylinder can deliver rapid force with less accuracy. Energy sources are diverse and in constrained supply (Hallo! An ideal life lesson). Rich walks the students through an exercise where they map out their "customer needs" and take inventory of "major strengths of their kit components." An example worksheet allows students to characterize prime movers based on deliberation and testing. A similar matrix would analyze sensors, competition tasks, and the probability/risk/reward of scoring points. Rich rolled this training out to all ME2110 sections.

Table 2. Example Worksheet: ME2110 Analysis of Prime Mover v. Required Function (rank 1-10)

	Prime Mover Type	Attribute or Specification				
		Response	Precision	Force	Duration	Cost
1	Motor					
2	Air Cylinder					
3	Solenoid					
4	Gravity					
5	Mousetrap					

The goal is to encourage student teams to develop ideas and sharpen each other by defending their decisions. This is followed by experimentation and iteration, so their theories can be tested and improved, or abandoned if necessary. There is a culture of being able to brainstorm and test ideas without judgement or undue regard for success or failure in Dr. Simmons's lab. Failure can often be as valuable a teacher as success. Students that learn this before graduation in a low-risk setting, often have a head start when they join the workforce.

Specifications: the currency of elegant product design. Assigning priorities in a complex system is a requisite first step to converting these qualitative needs into measurable engineering requirements. Product specs are everywhere, but many students have not stopped to consider that therein lies a teachable backstory. Rich pulls commons specs from popular products like vehicles or smart phones.

Table 3: Product specifications for MY18 Ford and Chevy pickup trucks

Specification	**Ford F-150**		**Chevy Silverado 1500**	
Starting MSRP	**$26,540**		**$27,485**	
Engine	3.5L TiVCT V6		4.3L EcoTEC3 V6	
Power (hp)	282 (@6250 RPM)		285 (@5300 RPM)	
Torque	253 (@4250 RPM)		305 (@3900 RPM)	
Drive Type	2WD	4WD	2WD	4WD
City	17	18	17	18
Highway	23	25	22	24
Curb Weight	4051	4305	4510	4785

A favorite is the comparison of popular pickup trucks made by Ford and Chevy. Several years ago, Ford made a strategic decision to convert its F-150 pickup body to an all-aluminum design. Rich often presents the backstory, shows two competing advertisement videos, and the head-to-head spec sheets, as in the simplified example in Table 3.

Critical thinking, and evidence-based justification: Is an aluminum frame a good idea? Why? Rich knows that Ford would not sacrifice the image of its best-selling line of vehicles if it hadn't done its engineering, and appreciates the improvement, however slight, in fuel economy and cost. But at the same time, the decision represents a risk. Rich also knows that steel can have certain advantages in durability, and walks through pros and cons as a class. Students begin relating this

to other traditional course work (strength of materials, def bods, statics, engineering econ). But wait…there is more than one right answer! Rich drove this home for one class by asking a quiz question about a common drinking container:

"Is the correlation between grip-ability and insulation value: positive, negative, or neither? Explain."

Rich explains to his class that any type of additional layer, such as rubberized coating, will enhance the drink bottle's ability to maintain its internal temperature. Rich pulls up the US Patent Office website search engine, and navigates the class to a patent where an inventor discloses a novel container with a sleeve that both insulates and provides better grip. This would mean the correlation is positive (more grip, better insulation). One third of the class celebrates: they've gotten it correct! Rich then explains that extended surfaces, like ribs and knurling, can help promote the flow of heat into or out of the drink bottle. He walks through the basic theory from a heat transfer text book. This would mean the correlation is negative (better grip, poorer insulation properties). Another third of the class cheers, while two thirds moan. What's going on? They can't both be right. Finally, a production drink bottle with large contoured features that align with thumb and fingers is displayed on the screen. A bottle like this would have improved grip, but negligible effect on the insulation of the contents. This means no correlation! The final third of the class sighs in relief. "But Dr. Simmons, we want to know the *right* answer." Everyone that defended their answer with logic, and defensible conclusions received full credit on this one (as shown in the table). Anyone that simply guessed without a suitable explanation did not receive full credit. The takeaway is of course that critical thinking, based on engineering judgement and analysis can lead to multiple answers/approaches that may be equally viable. This is both the art and the science of sound engineering design. Students invariably go on to exploit this knowledge in their end-of-term competition and reports. Moreover, they bring it forward into future classes, and ultimately into their early careers.

Table 4 Example quiz solution with credit for well-reasoned engineering justification

5. (2 points) Correlations are shown in the "roof" of the House of Quality. Note the bolded, blank diamond-shaped boxes. Please describing the following correlations, and justify your answers.

Engineering Requirement PAIR	**Correlation Type: +, -, or NONE**	**Briefly Explain**
Liquid Capacity AND Mass	*+*	*The correlation is positive because a larger container would require additional material, thus giving it more mass.*
Grip-ability AND Insulation Value	*+ (best answer)* *-* *(acceptable answer, if argued properly)* *NONE (acceptable if argued properly)*	*In general, the correlation is positive because most features that enhance the grip-ability of the bottle, would also contribute to improved insulating properties.* *However, in some rare cases (e.g., knurled surfaces or extended surfaces such as fins), the correlation could be negative, as improved grip-ability could actually result in a bottle that has lower insulation value.* *Finally, there could be situations where no correlation exists, for instance if the addition of grip-enhancing features do not substantively alter the surface or material thickness.*

Synergistic approaches to team formation. ME2110 is inherently a project-oriented laboratory course in which students submit some independent assignments, but the majority of the workload is accomplished in teams. This creates an opportunity for students to learn that collaboration can yield outcomes that are much greater than the sum of the parts. It can also be a bit unnerving for high achievers that have always been in "full control of their own destiny," since it is often the first academic team experience second-year ME students have had. Dr. Simmons has therefore developed a two-stage best practice for team composition. First, this entails a random assignment for initial project teams that will work together for the first 4-5 weeks of the course. This mirrors a common reality in the industrial workplace: sometimes you simply get assigned randomly to a team. This puts everyone on equal footing and avoids certain cliquishness that may result when friends enroll together. It also gives the instructor several weeks to assess core capabilities of the individuals, who work alone, in pairs, and in teams of 3-

4 students. The extended hour training sessions and oral presentations allow the instructor to monitor group dynamics as well. The second stage entails a more methodical assessment of individual strengths and combine a diverse set of capabilities to form functional teams. The second teams will undertake the major competition project which runs from weeks 5-15 and comprises about half of each student's overall grade. To ensure complementary teams, Dr. Simmons draws upon assignments and his observations during the first 4 weeks, and requests a self-assessment skills survey from the students. A sample skills survey is shown in Table 5.

Table 5. Sample self-assessment skills questionnaire

ME2110A4 (Instructor: Simmons) – Resident skills self-assessment for Big Project Team Formation

Please identify your individual strengths by **indicating the priority order of your top 2 skills.** A rank of 1 means this is your strongest skill in your own opinion. Please focus on actual skills and expertise you already have as of week 3 of this semester. **Submit on Canvas by Friday.**

Name _____

_____ CAD design and/or graphic design/artistic skills
_____ Programming skills (e.g., Matlab, Arduino, PLCs, other coding, robotics experience)
_____ Literary, report writing, communication and/or other organizational skills
_____ Machining skills and/or prototyping/fabricating experience

Table 6 Example showing team formation matrix

	SKILLS			
Student	**CAD**	**Programming**	**Communicat'n**	**Mach/Proto**
1	2	1	2	
2	1		2	
3	1	3		2
4	1	2	3	
5	2			1
6		1		2
7	1			2
8				1
9			2	1
10			1	2
11			1	2
12			2	1
13		2		1
14			1	2
15	2	1		
16		2	3	1
17	1			2
18	2	1		
19			1	2
20	1			2

Survey data were then combined with observations gained during the initial project to formulate teams for the big project. An anonymized example of the matrix used to develop final team groupings is shown in Table 6. Students assigned to a given team share the same color coding. Note the complementary skills that each team can expect in core competencies (1=strongest, 2=next strongest). Note also the comparative balance in skills across all teams, to promote equal opportunities. After conceiving of this approach in 2017 and iterating slightly upon it since, Dr. Simmons has shared this with a cohort of other instructors that teach the course to favorable results. These include a more supportive lab culture, a more rewarding experience for teams, more even distribution of effort, inclusivity, and better student engagement owing to the fact that individuals can contribute their value added while drawing upon others' strengths.

ME4182/4723: Senior Capstone Design

Capstone Design is the culminating laboratory course taken by many engineering majors in their final semester. It provides an unparalleled opportunity for students to build on all aspects of their undergraduate preparation, including lab-based, project-oriented courses like ME2110. It

presents each student team with a unique challenge, and often facilitates direct interaction with a lead faculty member, sponsors, and subject matter experts.

The need for a critical eye and a respect for the design and decision making process. Based on experience laying a foundation in sophomore level lab courses, Rich has become adept at helping students leverage those skills, and add in new capabilities that draw upon higher math, analytical reasoning, computing modeling and engineering analysis. A major focus area within each project is establishing a solid problem understanding and a realistic scope. Dr. Simmons assigns a project proposal package that carries no credit, and therefore offers student teams a no-risk opportunity to share unique ideas, and present findings of initial research into products, intellectual property, and market potential. Students often reflect on the value of spending this additional time to clarify the problem, narrow the scope, and mimic organizational approaches that are commonplace in the management of complex engineering problems.

Cracking the code on technical writing and oral presentations. An often under-appreciated skill in engineering courses is the ability to communicate clearly through the written and spoken word. This is paramount to success in Capstone and ME2110. Rich has developed a series of standardized report rubrics to help students navigate these essential parts of both courses. These rubrics are accompanied by clear assignment instructions and a guideline document, which clearly delineate what is expected for all written and oral deliverables. The rubrics explicitly describe required content and explain what is expected to attain full credit. Rich's approach to this is based on lessons learned, student suggestions and experience, and has been shared within the cohorts of Capstone and ME 2110 instructors toward standardization and clarity. It should be noted that the rubric is not a "report template" as if students were merely filling in boxes or entering numbers into a formula. Instead, the rubric provides a barometer for evaluating written and oral deliverables, while providing teams freedom to explain their approach in their own words. Teaching a section of Capstone is not like teaching one course, it is like teaching 5 or 6 different courses, where each team is solving a different problem. The onus is on the faculty to ensure each team follows a relatively common process and is subject to consistent evaluation criteria. In this sense, the rubrics used for written and oral deliverables have become invaluable.

Table 7. Example rubric for ME4182 Capstone Written Final Report with review criteria

Deliverable	Criteria	Points
Final Written Report	**Executive Summary** Concise, compelling, differentiating. Draws the reader in. Balances some tangible/quantitative results with high level findings, key insights. Impactful, but uses an economy of words.	5
	Problem Framing and Understanding ***"The project addresses an important need and is well framed"*** E.g., Clearly stated and realistic scope, problem statement and design objectives. Leverages HOQ and other design tools, Prior Art, Sponsor/Market, Identification of relevant codes/standards.	10
	Analysis and Innovation leading to Final Design ***"The design is well reasoned"*** E.g., Rigorous and relevant technical analyses. Evidence of creativity, ideation, methodical concept development, risk/safety, DFMEA, and preliminary and final design evaluation. Detailed design, CAD, clear design criteria and final engineering specifications.	25
	Impact of Final Design	15

	"The design works and will be successful" E.g., Provides performance prediction. Connects quantitative evidence (from modeling, experiments, external resources) that the design will meet objectives. Social Impact Assessment. Optional: Experimental test results, Lifecycle Assessment (if applicable), Operational/user guidance.	
	Project Management and Approach ***"The team's process is collaborative and effective"*** E.g., Effectively uses program management and design tools, Gantt chart, Task/Sub-task definitions. Plan was realistic, well organized. Responsibilities were distributed. Evidence of team work. Limitations are acknowledged.	15
	Format and Organization ***"The report is clear and professionally presented"*** E.g., Organization of document, coherence ("one-voice"), integration of sections, key content prioritized, complies w/formatting reqts., citations, page length, appropriate use of appendices, etc.	15
	Fabrication Package ***"The design can readily be understood & fabricated"*** E.g., Prioritizes critical attributes, effectively conveys design criteria to technicians. Design for manufacturability is evident and pragmatic.	15
	Total Score	100

The rubric is also used to convey grades and the extent to which deliverables met required criteria. Students in Dr. Simmons's lab courses comment on the valuable feedback he provides for written reports and oral presentations. Such feedback is typically very clear and detailed (often 2 or 3 pages). Students appreciate that the feedback is constructive, critical and direct. It not only identifies areas where improvements are needed or to correct calculations/engineering analysis, but it also reinforces strengths, creative contributions, and evidence of team work. Many students are pleasantly surprised that their busy instructor takes time to not only read lengthy reports thoroughly, but also provides recommendations to improve upon them for next time. Students learn that it is not enough to have clever ideas or fabricate great machines, but that communication of their approach and results is a skill that will deepen their impact. Rich creates an open and fun classroom environment where students can question and brainstorm, while honing their interpersonal skills and ability to communicate complex ideas.

Standing on the shoulders of giants and students that have gone down this road before. Few students in Dr. Simmons' labs have finished a semester without an in-person guest appearance from former students of the class. Typically visits occur at strategic junctures when students most need advice on competition/expo, optimizing resources, team dynamics, budgets, prototypes, testing, etc. An open Q&A session follows to ensure they don't feel alone facing challenges in ME2110 or Capstone. Recently, Rich has organized and moderated an "alumni panel" during Capstone lecture for this purpose. Dr. Simmons has compiled a running document with a list of "advice for future students," based on lessons learned of students that have recently completed the course. This is voluntary, and surprisingly, most students are happy to contribute advice or an admonition. Why? Perhaps because they received advice themselves, from former students that paid it forward. One team from Dr. Simmons's class even created and posted a youtube video with an inside look at ME2110 that has been viewed >1200 times. It is the essence of engineering to learn from engineers that have preceded us. Not to copy them, but so that our own knowledge can have a strong foundation, and we can, collectively, advance all the further.

A focus on energy and sustainability. The world has never been more attuned to the impact our decisions have on people and the planet than it is today. Developing clean and sustainable energy solutions is the grand challenge that motivates Dr. Simmons's research at Georgia Tech. Efficient use of resources is essential for sound engineering design. As such, Rich regularly delivers formal lectures to the entire cohort of students enrolled in both ME2110 and ME4182 on design of sustainable systems. He often conducts demonstrations and explains how system boundaries are critical to understanding net energy flows. He typically walks through relevant examples and case studies from his own research in clean transportation, Electric Vehicles, and fuels like hydrogen and biofuels. He concludes with a discussion around lifecycle assessment as a tool for understanding energy and environmental impacts at each step in the chain of a product's life--be it mining/extraction, transportation of raw materials, manufacturing, use phase, or end of life. Many students are intrigued to probe further into these topics, seeking follow ups, resources, career ideas, and individual discussions with Dr. Simmons following such lectures.

Maintaining morale and student engagement. Georgia Tech can be a stressful place. Rich has collaborated with instructional teams for ME2110 and ME4182 to manage course requirements and learning objectives with rigor, a sense of priority, and realism for demanding 3 credit hour courses. An approach Rich has taken to mitigate stress and increase morale for students is via a series of quick, informal, no-credit, in-class challenges to stimulate thinking around core objectives. Of late, this includes a brief intro/demo, followed by team discussion and back of the envelope calculations (~10 min). Elevator pitches (~1-2 min) are given by the 5-6 teams in the lab section. These challenges begin after midterm and continue to week 15. The challenge topics address a team's product or process and its ability to address: societal needs, economic goals, customer needs, engineering rigor, specifications, sustainability, or market potential. Rich concludes the weekly exercise by asking student teams to cast anonymous votes for the teams that made the most convincing and definitive arguments. The weekly winner(s) is decided by peer vote, and a symbolic award may even be granted to the winning team for one week. The award may be re-issued to a new winner the following week, and so on. At times, Rich has also organized a superlative poll at the end of the semester, again using student peer vote in various fun and informal categories, to help all teams celebrate their respective successes.

Evaluation Instruments and the Voices of Students

Table 8. Aggregated* CIOS data for R. Simmons in ME lab courses** by instructor criteria, 2016-2022

Instructor Criteria	Total Responses	Weighted Score
Clarity	244	**4.8**
Communicated How to Succeed	245	**4.8**
Respect for Students	242	**4.9**
Enthusiasm	243	**4.9**
Stimulates Interest	244	**4.7**
Availability	242	**4.9**
Feedback helpfulness	242	**4.8**
Inclusive***	81	**4.9**
Overall Effectiveness	244	**4.9**

* 386 total students. 343 students in survey pool. 245 total students responding (~71.4%)

** Courses include: ME4182/4723 Capstone (92 students, 3 semesters); ME2110 (274 students, 14 semesters)

***(new criterion added in Spring 2021-)

Aggregated instructor ratings are provided in Table 8 for laboratory-based courses that Dr. Simmons has taught since 2016. These data were obtained via GT's quantitative instrument, the Course Instructor Opinion Survey (CIOS).

Dr. Simmons has encouraged candid anonymous written feedback and benefited immensely from student input provided via CIOS. As examples, constructive student suggestions to address report requirements, burdensome workloads, project team pitfalls/dysfunction, and lecture content have resulted in vastly improved rubrics, syllabi, teaming best practices, engaging demos and more relevant lectures, as explained above. Broadly representative, anonymous student comments from CIOS reports, amplify Rich's strengths and educational impact:

- "We need more professors like Dr. Simmons. Professors who make an effort to be involved with their students; not just giving lectures and tests, but trying to make a real difference in the lives of the people they teach."
- "Dr. Simmons made me love Mechanical Engineering."
- "Dr. Simmons is one of the few instructors that is understanding, effective, and enthusiastic. Most professors have one of those characteristics, some have two, very few have all three. Dr. Simmons has all three."
- "He is a phenomenal teacher, mentor, and person. He not only uses engineering, but personable skills to elevate the learning experience of this class. By far my favorite professor so far."
- "I would take any class taught by Dr. Simmons. I feel like I learned more about engineering in the real world from Dr. Simmons than every other college class combined (and I'm a 5th year dual degree student)."
- Dr. Simmons was an incredible instructor for this course… He allowed for the students to get general knowledge as well as specific support each week. He also took time to speak to me one on one on general career and educational questions which was invaluable. He cares about his students and it shows in his advising style and relationship to his students.
- I cannot stress enough the positive impact this professor has had on not just my experience in Capstone, but my overall understanding and excitement about graduating as an ME from Tech. In terms of this class, you were not only clear, but you also made yourself and other resources widely available to us. Every bit of feedback was more than helpful and even regular commentary was exceptional. I only wish I could've had you for other classes.
- Dr. Simmons was an excellent instructor. His feedback was thorough and very useful in helping us improve in our next report. It was very helpful to hear what a very experienced engineer had to say about our reports, because it helped us to think more like engineers.
- His enthusiasm is unmatched, his mind cannot help but think about engineering and want to teach and show people about it. He was always bringing in presentations about something he had that broke and tying it into class or showing us cool things in the news that were engineering related.
- Great ability to show students how the class was relevant to the real world. Added his own information outside of set course material that really helped students to work better through problems as a team. Made it clear what it would take to succeed in the course grade-wise, as well as what it would take to win the competition.
- I liked the "do it for the learning experience, not for the grade" kind of attitude. A lot of times us students get too wrapped up in trying to get an A in the course that we actually don't bother to learn anything at all. But when we are freed of this burden, all of a sudden we start soaking in information like sponges. It's crazy, weird and I don't understand why. But I felt like Dr. Simmons greatest strength was getting us to relax and focus on becoming better engineers, not better students.

- Excellent teacher and role model.
- Dr. Simmons was very good at motivating me to want to do better. He laid out how to do well in the course and on the final project, and always motivated our team to think of different approaches to solving problems.
- Dr. Simmons is by far one of the best professors I've had at Tech! I truly love how he genuinely cares about each student and wants us all to succeed. He makes himself available, constantly gives feedback on our assignments to help us improve, brings in previous students to give us tips and tricks to do well in the course, and he is extremely knowledgeable. Through his teaching, you can tell he is extremely passionate about the subject matter and the students as a whole.
- The feedback was always very detailed and good. Dr. Simmons really knows what he is talking about in this course; he always brought so many personal stories into it which made it real-world related, loved it!
- I'm not sure how he does it, but I actually want to listen to him when he talks.
- Really knowledgeable and helpful with all problems. Very understanding and cared more about students learning than obtaining grades.
- Great analogies that brought abstract topics into perspective, great guy and extremely helpful on all levels.
- Dr. Simmons is my favorite professor so far at Tech, he is very knowledgeable about engineering and has insight into what we did in the class that furthered my interest in ME.
- A great human being. He would always want everyone to succeed and do well.
- Loves what he does, has a great grasp of what the course means to the real world in terms of engineering and uses this to relate our assignments to the work place of engineering.

Broader Impacts

Enhancing connections between GT research faculty and undergraduate students. In 2022, Rich was invited to participate in the Woodruff School Academic Leadership and Management Fellows Program. In addition to attending 12 weekly interactive sessions, each participant conducted a self-defined focus project over the course of the semester. Rich was motivated to address gaps and opportunities that exist between undergraduate students and research faculty. Namely, that students lack visibility to activities being pursued by non-tenure-track faculty; and that research faculty have infrequent opportunities to interact with undergraduate students. Because Rich has been involved teaching laboratory classes, he has recommended some possible mechanisms for facilitating more interactions and sharing about part-time undergraduate research opportunities for credit or pay. He also has acquired experience writing (40+) Letters of Recommendation and providing career advice for students. Though some students may continue their studies after graduating, many will immediately enter the workforce. As an experienced Professional Engineer, Rich has keen insights on how to counsel students, and his input is helping GT provide more attention and resources to help address this gap, and turn it into an opportunity.

CEISMC K12 Summer Camp Program: Energy Unplugged. In 2019, Dr. Simmons conceived of this new energy-themed STEAM camp. The program is administered by Georgia Tech Summer P.E.A.K.S. (Program for Enrichment and Accelerated Knowledge in STEAM) at CEISMC (the Center for Education Integrating Science, Mathematics, and Computing). CEISMC serves as the primary connection point between Georgia Tech faculty and students

Figure 2a Students with Steam Engine

and the preK-12 STEAM education community, reducing the barriers between kids and higher education. The program consists of hands-on activities, interactive demonstrations, presentations, and local tours of campus energy sites, and field trips to a working power plant and an energy monitoring center. The course includes segments on how electricity is generated, where it comes from, where it goes, what it costs, its environmental impacts, and how it might be brought to more of the world's 2.5 billion people without sufficient access to electricity. Camp students (Fig 2b) gain insights into microgrids and electric vehicles by conducting experiments involving solar panels, batteries, and remote-control cars. Dr. Simmons has hired undergraduate and graduate students to support the program in two ways: (1) by interacting with students during the camp, and (2) by helping design and fabricate certain prototypes and demonstrations used for signature activities, including the mini-steam generator (Fig 2a) and the RC car (Fig 2c) with energy monitoring capabilities.

Figure 2b 2022 Energy Unplugged Students & GRA with Dr. Simmons

Figure 2c Students driving RC car

Students also talk to researchers who are making electricity cleaner and more efficient, while learning about the future of energy and how a STEAM-oriented education can be a path that leads to an energy career. The week typically concludes with presentations of team projects which focus on a different problem each year, and are reviewed by visiting subject matter experts. In 2022, high school instructors were recruited to help administer some of the interactive demos. A goal in the future is to develop a track for teachers to participate throughout the program, and to bring lesson plans back to their schools to integrate experiments into their formal STEM curricula. Camp administrators conduct a pre- and post- program survey, and also acquire anonymous comments from the High School students that participate. An example of this survey data for the most recent year is provided in Table 9.

The data in Table 9 indicate that the camp is highly effective at achieving several of its key learning objectives, including awareness of energy generation and usage, as well as pathways that can lead to careers related to the energy sector. 92% of respondents said “Yes” when asked if they would recommend the program to friends.

Table 9. HS Student Survey Data Energy Unplugged Summer STEM program (CEISMC)

Energy Unplugged (HS, June 21 – June 24)

How confident do you feel…?	Pre (n=17)		Post (n=13)		Difference
	M	*SD*	*M*	*SD*	(Post *M*-Pre *M*)
…creating a mobile device charger powered by solar energy?	1.76	0.90	3.15	0.69	+1.39
…describing jobs you could have in solar energy?	2.18	0.88	3.15	0.80	+0.97
…describing jobs you could have in sustainability?	2.29	0.85	3.23	0.83	+0.94
…describing how energy is generated in fossil fuels, nuclear, and renewable energies?	2.29	0.77	3.15	0.69	+0.86
… using data to identify trends in energy usage in the US?	2.41	0.71	3.15	0.80	+0.74
…describing jobs you could have in research?	2.53	0.87	2.92	1.04	+0.39

Note. Students rated their level of confidence using a 4-point scale, such that 1=*not at all confident*, 2=*somewhat confident*, 3=*confident*, and 4=*very confident*.

Perhaps equally encouraging are the numerous emails Dr. Simmons receives from students participating in the camp. Selected students participating in Energy Unplugged emailed with the following comments:

- "I had a great time learning about renewable energy and I'm eager to find out more ways we can generate clean energy, such as the green building we visited and projects at the robotarium. I'm very interested in receiving the links you mentioned."
- "I want to thank you again Dr. Simmons for taking time from your summer to teach the Energy Unplugged. Because of you, I have a strong desire to pursue my education in engineering, and like you, I like to be involved and get my hands dirty."
- "I just wanted to say thank you for all of your hard work and effort during the one-week camp and that I really appreciate it. You opened up an entirely new perspective for me about clean energy forms and how they can be utilized.

Others have followed up to explain how they are applying lessons they learned, and using resources provided. During the Energy Unplugged camp, Dr. Simmons conducts a number of experiments in which the students participate. These include constructing/launching a catapult, water rockets, measuring electrical loads of common devices, charging phones with solar energy, etc. A student favorite is a simple experiment that reveals the power and energy consumption of three light bulb types on the same fixture: incandescent, compact fluorescent and LED. There is no "directive" for anyone to change any light bulbs- simply an experiment and a group discussion about its implications. This is a core philosophy: Dr. Simmons encourages his students (at GT or anywhere) to experiment, ponder and respond in their own ways to what they are learning. Consider this brief excerpt of an email from one camp participant, representative of the unique impact this camp has, with obvious roots in experiential learning:

- "I just wanted to let you know that from the last time I mailed you to today I have successfully changed all the light bulbs in my house from incandescent to LED. From the garage lights to my room every light bulb in my house is now LED."

Energy 101 Southeast Online Video Short Course. Dr. Simmons has developed an online initiative to reach general audiences to convey fundamental energy knowledge. Though the initiative is not a formal accredited course that carries credit, it has provided a platform for experiential learning for Georgia Tech students in different ways. Sponsored by Georgia Tech's Strategic Energy Institute (SEI), Dr. Simmons has engaged undergraduate students in part-time roles in the preparation, filming and editing of the video series. This includes 3 with SEI that have conducted research into energy data, trends, and resources, and another 3 with Georgia Tech's School of Literature, Media, and Communications (LMC) that have performed filming, editing and film production activities. Hands-on discussions and selected experiments are embedded in the course, along with an extensive list of additional resources. The course would not have been possible without the contributions of the students, who benefited from experiential learning of a different kind. The video short course gives credit to student contributors, and can be accessed via the following link: https://epicenter.energy.gatech.edu/energy-101/

Closing Thoughts

> "Be aware of what is required, and excel at those things, but also… do the things that feed your soul."
> *-Prof Raheem Beyah*[1]

Grades and evaluation tools represent quantitative metrics for teaching and learning. In this vein, the proficiencies and accomplishments of Dr. Simmons's students these past seven years are strong and growing. Achievements that he had a small, but important role in. Good grades, to be sure. Preparation for future classes, of course. Graduations and the beginning of a career, or an advanced degree. Students have expressed what their experiences in ME2110, ME4182 or Energy Unplugged, have meant to them. They have also provided valuable feedback to make improvements. Acting upon this feedback has led to the creation of better resources, experiences, preparation. It permits GT to scale and institutionalize best practices and quantify progress through accepted metrics. At the same time, Rich's contributions to experiential learning derive from a passion to serve, and to improve the lives of others. There is an intentional connection between formal labs, where the experiential learning takes flight, and summer STEM programming. One day, not long ago, that senior in Capstone, was herself a sophomore in ME2110, and not too much further back, she was a junior in High School researching summer STEM programs. And one day, in the not too distant future, she may also become a Graduate TA, grading assignments, or supporting outreach projects. Or she may earn her PhD, a PE license, a patent, serve as a policy advisor in Washington, DC, or enter the workforce as a spokesperson for a new generation of engineers. She will stand on the shoulders of those that paved the way, including her younger self. Perhaps she will return to judge the Capstone expo, or the 2110 design competition, and pay it forward. Perhaps she will look back on 2023 in 2053 and talk about how far Georgia Tech has come in her 30 year career. These are the kinds of audacious thoughts that inspire Dr. Rich Simmons to become a better instructor, and feed his soul.

[1] Prof Beyah's advice to faculty and researchers for navigating the system of promotion & tenure, yet staying true to one's own mission, values, and character. From 7/14/20 online panel discussion, "Experiences of Black STEM in the Ivory: A Disruptive Call to Action."

George W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology
801 Ferst Drive, Atlanta, GA 30332

04 February 2023

Dear CTL awards selection committee,

It is my pleasure recommend Dr. Richard Simmons for the Innovation and Excellence in Laboratory Instruction Award. I have worked closely with Dr. Simmons over the past 7 years as a colleague collaborating in the instruction of our sophomore-level design course, ME2110: Creative Decisions and Design. This course is a core element of our School's design/build curriculum and is focused on introducing students to structured, team-based design methodologies, mechatronics programming, physical system design and rapid fabrication approaches. As coordinator for the course, I organized the primary lecture section in coordination with Dr. Simmons' delivery of the laboratory studio section where he mentors students as they apply their knowledge in a hands-on and experiential manner on real-world projects. Through our collaboration, I have been able to closely observe and learn from Dr. Simmons' laboratory instruction approach. I elaborate below on major aspects that set him apart from his peers in terms of excellence in laboratory instruction.

Dr. Simmons has brought a unique perspective to the laboratory environment leveraging his diverse past experiences in industry, small/large business, governmental policy and research and development. In particular, Dr. Simmons provides his students with many hands-on examples and in-class demos from real-world engineering problems to explain core design concepts or convey other course objectives. This is critical for ME2110 as our students have acquired the core understanding of how to analyze various conceptual design problems but have yet to understand how to apply these principles in a broad context. Complementing these efforts is a strong focus that Dr. Simmons maintains with his students on engineering rigor, creativity and the merit of well-developed prototypes and experimental inquiries. From a classroom/laboratory environment perspective, Dr. Simmons has taken active steps to create a culture of collaboration between his students in the laboratory. In this regard, Dr. Simmons seeks to foster an open and collaborative classroom environment where students are free to converse/debate/question/challenge and learn from one another. Dr. Simmons has always established mutual respect with his students, including making sure he is available for discussion, that he quickly responds to all student questions/email promptly, is considerate of personal situations, and is also fair and consistent in upholding syllabus and course policies.

Dr. Simmons has introduced a variety of enhancements to the ME2110 laboratory that we have sought to seek to implement across the entire instructional team. One example has been an iterative approach to team forming, including careful assessment of team strengths/aptitudes and other factors based on the initial performance. We have found that this practice has led to

better team capabilities, collaboration and chemistry and I have adopted it when I form teams in group projects. Additionally, Dr. Simmons has helped with the formation of well-formulated standardized rubrics that are available for other instructors to adopt in their approaches. Dr. Simmons also has been an active participant in contributing to course improvements, with particular focus on technical writing, student workload and time management, sharing of best practices, and offering guest lectures on sustainability. These efforts have been impactful on our team as several have been standardized for use across the entire course.

Dr. Simmons students have been highly recognized by his students as an excellent instructor from their feedback in end-of-term evaluations and informal feedback I have received. Across these feedback, students were particularly appreciative of Dr. Simmons' ability to explain academic concepts in real world terms using examples, analogies, problems, and demonstrations. Additionally, students have noted that Dr. Simmons excels at providing clear and detailed feedback and in creating a culture of respect and concern for students. Most notably, Dr. Simmons consistently earns perfect marks for inclusivity in his laboratory instruction.

Complementing his excellent contributions as an instructor, Dr. Simmons also has significant broader impact on training of diverse audiences in activities outside of the classroom. He has brought his understanding of energy systems and energy policy to diverse groups across students, faculty/staff and the broader public. Among these activities, Dr. Simmons is an active instructor for STEM summer camps with the Center for Education Integrating Science, Mathematics, and Computing (CEISMC), has supported running of merit badges for boy scouts and girl scouts, has created online video short courses and podcasts on energy systems and energy policy and serves on doctoral and thesis committees for our graduate students.

In conclusion, Dr. Simmons has had a significant impact on our students through his passion and excellent laboratory instruction. He has been highly impactful on my efforts to hone my teaching practices and his efforts have helped our teams to mold the student experience to bring unique and novel approaches to design thinking. Dr. Simmons is quite simply an outstanding role model that exemplifies the qualities of a student-focused instructor. I give my absolute highest recommendation for this nomination.

Best Regards,

Dr. Christopher Saldaña (christopher.saldana@me.gatech.edu)
Ring Family Professor and Associate Professor
George W. Woodruff School of Mechanical Engineering

Azell Francis
Graduate Research Assistant
Scheller College of Business
Georgia Institute of Technology
800 W. Peachtree St. NW
Atlanta, GA, 30308
02/04/23

Dear Award Selection Committee:

It is with great pleasure that I pen this letter in support of Dr. Simmons for this prestigious honor. I have had the privilege of learning from and being mentored by Dr. Simmons, and I truly cannot sing his praises enough. To share a bit of our background, I first met Dr. Simmons in 2018, when he served as one of our keynote speakers for the Southeastern Energy Conference hosted by the Georgia Tech Energy Club. Since then, he has continued to be actively involved with the GT Energy Club, Drawdown Georgia, and I had the privilege of working closely with him to lead the GT Energy Unplugged Camps during Summer 2022.

In five years of knowing Dr. Simmons, I can with confidence say that he represents the best of the best faculty, and is an ideal representation of lab instruction excellence and the University. I have been so fortunate to have had the opportunity to work with him in various capacities, and Dr. Simmons is, without doubt, a student-oriented Professor whether he is carrying out teaching, research, or service-related activities. As a Professor, not only was he an excellent instructor, I vividly recall that he always showed that he cared, and would go above and beyond to help. He was always sensitive to the needs of his students, and would not hesitate to reach out to individual students and offer additional help or resources if they were struggling.

At the same time, Dr. Simmons' teaching approach, philosophy and engagement with students helped to provide an environment and opportunities to bring the world into the lab for visiting STEM high school students, GT students, faculty and staff. I loved that he takes a very practical and collaborative engineering design thinking approach to problem solving and that his instructional approach always involved and centered on students. So much so, that though he is not technically on my Dissertation Committee, I have often turned to him for advice and mentorship. I have grown as a researcher and a scholar under his guidance, and he has helped to nurture my ability to conduct independent yet guided research. To this end, his guidance and influence are a large part of my incredible student experience during my Ph.D. at Georgia Institute of Technology. Dr. Simmons' mentorship, instructional and research supervision excellence does not end with me. In fact, it is well-known that teaching is by far the most gratifying part of Dr. Simmons' current appointment. His strong student orientation, his supportive and friendly attitude, and his approachability make him very popular among students. Additionally, Dr. Simmons possesses an ability to bring out the best in any student and this has contributed to his students' success in their careers.

Last summer, as a Fellow with the Strategic Energy Institute, I had the opportunity to co-lead an initiative that was the brain-child of Dr. Simmons, "Energy Unplugged". "Energy Unplugged" is a week-long energy-themed STEAM camp for 35 high school students. Dr. Simmons led the engagement with collaborators from around the state, and facilitated learning for the campers in hands-on interactive demonstrations and experiments involving solar panels, batteries, catapults, water rockets, and remote-control cars. For many of the students participating in the summer camps, this week-long experience was their first introduction to the Georgia Tech student experience, and the majority of them at the end of the week indicated their plan to apply to Georgia Tech for college. Again, lending credibility to his student-first instructional philosophy. Having been actively involved with the Strategic Energy Institute myself, I know that Dr. Simmons is instrumental to outreach efforts and has often served as the face of student outreach for the Institute including being the instructor for the Energy 101 Mini MOOC. He believes the success of the student starts early and is dependent on their exposure to and understanding of fundamental concepts. He regularly engages with high schoolers in STEM and keeps up with them demonstrating his investment in their success even past their participation as an Energy Unplugged camper. As a former President of the Georgia Southern chapter of the Society of Women Engineers and recognizing the need for more women and girls in Mechanical Engineering, Dr. Simmons made a concerted effort to encourage girls to participate in Energy Unplugged and he facilitated my active involvement during these week-long camps to encourage minority students to consider engineering. Dr. Simmons is a fantastic ambassador for Georgia Tech.

Dr. Simmons is excellent at developing and maintaining relationships with his former students, mentees, and regularly serves as a reference. This includes his willingness to write recommendation letters for graduate school applications or even make connections to potential employers on our behalf. These acts are yet another example of his commitment to student success within and beyond Georgia Tech, inside and outside of classroom instruction. As I close, I want to share one more recent story that speaks to Dr. Simmons' deservedness of this award. A few weeks ago, the Strategic Energy Institute hosted a visit from a few members of the Georgia Public Service Commission. Without any hesitation, Dr. Simmons reached out to ask me if I would help him present. This opportunity though for him was a no-brainer and not a big deal, was a significant one for me as it allowed me the opportunity to be exposed to energy leaders and decision makers in the State of Georgia. Dr. Simmons is a prime example of a professor who has dedicated his professional career to the success of students. In my opinion, Dr. Simmons has already earned the award for instruction excellence countless times over, but his obtaining this honor will grant him the recognition he so rightly deserves.

Sincerely,

Azell Francis

Chelsea Whitt

February 02, 2023

To Whom it May Concern,

I am writing to you to express my strong support of Dr. Richard Simmons for the 2023 Innovation and Excellence In Laboratory Instruction Award. During my time as an Undergraduate Student at Georgia Tech, I had the immense privilege of knowing Dr. Simmons as both an ME2110 professor and a research mentor through the PURA (President's Undergraduate Research Awards) scholarship program. I can confidently say that it was a direct result of Dr. Simmon's mentorship, contribution and passion for automotive and energy research that I am following the career path I am on today, having now spent several years as a Mechanical Design Engineer specializing in electric vehicles. Prior to meeting Dr. Simmons, I held a great interest in architecture and structural engineering and had little to no intention of pursuing a career in the automotive industry. I was extremely limited in the amount of knowledge I had concerning vehicles at all, and although I did have an interest in learning about them, I admit that I felt a great deal of insecurity at the risk of appearing naive or unintelligent to my peers who had been exposed to the mechanics of engines and automobiles since a young age. It was only through Dr. Simmon's bright spirit and intentional, compassionate style of instruction that I was able to find an environment where I could deepen my understanding of the world of energy, and scientifically apply it to growing my fascination with electric vehicles.

As a professor for the ME2110 class, Dr. Simmons actively encouraged student learning by fostering a friendly, experiment-centered environment, where any time a question was asked, his smile was accompanied by an answer of "Why don't you try it and see what happens?" The once quiet classroom quickly changed to reflect the buzzing around of excited students as we discussed new ideas and developed prototype mechanisms to test our theories. In a world where so many of us (myself included) can swallow great ideas for fear of making a mistake or failing, Dr. Simmons challenged our thinking and taught his students that mistakes are okay, and that they are often necessary in order to find success.

During my Senior year at Georgia Tech, I had the privilege of partnering with Dr. Simmons under the PURA Scholarship Program to investigate optimization of multiple performance objectives using small scale, low cost, remotely controlled vehicles. With Dr. Simmon's support, I was able to gain new insights on the energy consumption of electric vehicles as it relates to variables such as safety, time, efficiency, energy usage, cost, and driving mode. We also developed a small-scale prototype electric vehicle which we used to generate data to define our results. To this day, I often still think back on that semester filled with gratitude, for although my experiences in the industry were limited and I had so much yet to learn, Dr. Simmons always made me feel like an equal, valuing my thoughts and questions and never hesitating to invest his time in an opportunity for me to learn. While any average professor or

research program would have been perfectly satisfied with the scope of our research being exactly as mentioned above, Dr. Simmons truly set himself apart by initiating and encouraging that we use our research to then pursue STEM outreach in local highschools within the suburbs of Atlanta. As specific engineering related topics rarely come across a young classroom setting, I am deeply grateful for Dr. Simmon's character which went the extra mile to extend our laboratory setting into the high school classroom, where students were able to have hands-on experiences with our prototype to better understand energy transfer within an electric vehicle and see graphs of the data that was being collected as they operated the prototype in real time. While I can think of several examples that further highlight the selfless and authentically enthusiastic character which embodies Dr. Simmons, I believe his contribution to the students at Alan C. Pope High School truly exhibits his willingness to go above and beyond any expectation for the benefit of students at all levels.

It is with unwavering confidence that I can say that no one is more deserving of this award than Dr. Simmons. Not only is his lab instruction absolutely phenomenal, but it is also driven with a deep sense of purpose. From personal experience, I have seen how Dr. Simmons approaches the laboratory as not only a method to teach and apply theoretical concepts in a real world setting, but also as a method to spark greater interest in his students and guide them to engage in real world problems - many of which these same students will carry on to solve in their future careers.

The value that Dr. Simmons brings to both the Mechanical Engineering Department and to Georgia Tech is unparalleled. It is with a great amount of gratitude and honor that I fully endorse Dr. Richard Simmons's nomination for the 2023 Innovation and Excellence In Laboratory Instruction Award.

Sincerely,

Chelsea Whitt
Undergraduate Degree in Mechanical Engineering | Class of 2018

Georgia Institute of Technology

February 1, 2023

To whom it may concern,

My name is Brett Delozier, and it is a sincere pleasure of mine to recommend that **Dr. Richard Simmons** be the recipient of this year's Innovation and Excellence in Laboratory Instruction Award. I am a recent graduate from the Georgia Institute of Technology with a BS in Mechanical Engineering where I was blessed to have Dr. Simmons as my lab instructor for the ME Capstone Design class. It is my understanding that the title of "Engineer" is merely a fancy way of calling oneself a "problem solver". After having taken the ME Capstone Design class with Dr. Simmons as my instructor, I can say with absolute certainty that Dr. Simmons has taught me (and all my classmates) how to be a better problem solver. He accomplished this deed by the following three actions: (1) instilling, in each student, a desire to learn, (2) teaching each student what it means to have good work ethic and never give up, and (3) showing each student how to be resourceful. Above all the theoretical things that Georgia Tech taught me, it is these three qualities that I deem most important, and Dr. Simmons played a large role in teaching me them. Allow me to use this letter to provide a few examples as to why Dr. Simmons is a top tier innovative and excellent laboratory instructor at Georgia Tech.

Dr. Simmons constantly worked to improve student learning by assisting students in developing a deeper knowledge of foundational theory. The steps of problem solving can be broken down into these four main stages: 1) problem understanding, 2) developing alternative solutions, 3) implementing the best solution, and 4) rigorously measuring the results. Dr. Simmons took the skills I had already gained from GT in these four areas and refined them to solve a real-world problem (clogged gutters). He did this by asking my team challenging questions about ALL design constraints and design challenges to affirm that we understood the full scope of the problem. He provided space outside of his lab for my team to test a working prototype for our design. He even worked overtime to help my team collaboratively develop a rigorous method to measure the performance of our prototype objectively.

Through very detailed comments on reports, Dr. Simmons encouraged students to engage in the processes of evaluation, testing, and reflection. From a disassembled cell phone transformer to an automobile thermostat to a AC control box from a crawl space, Dr. Simmons brought real world problems into the classroom that we as engineers might solve in the not so distant future. He used these examples to demonstrate the logical steps of trouble shooting and problem-solving using concepts learned in theory. Additionally, Dr. Simmons constantly created a collaborative atmosphere where each of my classmates and I were actively participating with one another. I have always said that "one can be the smartest/best thinking engineer in the room, but if he/she can't convey those thoughts, it means nothing". Through collaborative measures set up in his classroom, Dr. Simmons strengthened my communication skills so that now I feel better prepared for the workforce.

Perhaps the most important thing that Dr. Simmons taught me was not something he told me with his words, but something that he showed me with his actions. A few weeks before the Capstone Design Expo, a teammate and I showed up outside of his lab on a Friday afternoon to test a new design implementation on our gutter cleaning tool prototype. Instead of siting in a comfy chair in a cozy office before the weekend, Dr. Simmons was pressure washing the sidewalk in addition to some equipment that he intendeds to send overseas for an off-grid solar project. Even while being wet, cold, and dirty he came over to observe the new design implementation in our project, and he promoted a collaborative discussion with us on the device. During this interaction, I remember him telling me that "as an engineer, you've got to be willing to get dirty". Dr Simmons doesn't just talk the talk – he walks the walk as well. He taught

me that the view of being an engineer is spectacular, but the climb makes it all the more sweeter. With a hard work ethic and willingness to learn, no problem is unsolvable. This is what Dr. Simmons taught me that Friday afternoon.

Now that I have joined Dr. Simmons in being an alumni at Georgia Tech, I know why he is so willing to give back to the school that has taught us to be a 'helluva engineer'. He has without a doubt enhanced my experience at Georgia Tech. Because of him, I am a better person and engineer. I firmly endorse Dr. Richard Simmons for the 2023 Innovation and Excellence in Laboratory Instruction Award at Georgia Tech, and I do so with the utmost confidence that he is deserving of this distinguished award.

Sincerely,

Brett Delozier
George W. Woodroof School of Mechanical Engineering
Brett.d00@gmail.com // 706.308.6955

February 5, 2023
Georgia Institute of Technology
Innovation and Excellence in Laboratory Instruction Award

Dear Committee Members,

I am writing this letter of recommendation in support of Dr. Richard Simmons, who is a nominee for the Innovation and Excellence in Laboratory Instruction Award at Georgia Institute of Technology. I had the privilege of being his student in the class Creative Decisions and Design (ME 2110) in Spring 2019 and I can attest to his exceptional ability as an educator.

Dr. Simmons has a unique talent in enhancing student learning by helping them deepen their understanding of fundamental concepts. He expertly integrates hands-on laboratory work and real-world problems into the course curriculum, which enables students to apply the concepts they have learned in a practical setting. This approach has been instrumental in reinforcing students' understanding of complex topics and has also encouraged students to take ownership of their learning.

Dr. Simmons is also a master at promoting student participation in the processes of investigation, analysis, and reflection. He consistently provides opportunities for students to think about, discuss, and solve real-world problems. He fosters an environment that encourages students to ask questions and actively participate in the learning process. His approach has led to increased engagement among students and has resulted in a more dynamic and meaningful learning experience.

In addition to his ability to foster student engagement and participation, Dr. Simmons is also highly skilled at engaging students in collaborative problem solving. He encourages students to work together on projects and to learn from each other. This approach has resulted in a more collaborative and supportive learning environment and has allowed students to develop important teamwork and communication skills.

Finally, I would like to emphasize that Dr. Simmons has made a lasting impact on my learning experience at Georgia Tech. His contributions helped me to land my dream job at Apple. He has a genuine interest in his students and is always available to help and support them. He has contributed to a positive student learning experience and has set a high standard for what it means to be an excellent educator.

In conclusion, I highly recommend Dr. Richard Simmons for the Innovation and Excellence in Laboratory Instruction Award. His dedication, passion, and commitment to student learning make him an ideal candidate for this award and I am confident that he will continue to make a significant impact on students' lives in the future.

Sincerely,
Abigail Kiratzis
Class of 2020

To whom it may concern:

I am writing this letter in support of Dr. Simmons's application for the Innovation and Excellence in Laboratory Instruction Award. I had the pleasure of being taught by Dr. Simmons in the ME2110 section that he had in the Spring of 2021. I had heard that this class totally depends on your lab professor, and I was nervous to find out who I would have. I am so thankful I had the opportunity to be in Dr. Simmons's section. From the beginning of the class, you could tell that he was very passionate about his work as a mechanical engineer. It was clear that he wanted to share his experience so that we would also become passionate about the field and improve our hands on skills and engineering intuition alike. I believe he represents the best of the ME school's instructors and deserves this award.

One of the best parts about going to class taught by Dr. Simmons was the surprise additional problem he would present. In at least half of our lab sections in ME2110, where we were mainly learning about building a small competition robot, he brought up a quick real world problem to get us thinking. He came in one day and said, "How long should a refrigerator pump last? Does 10 years sound reasonable?" and proceeded to show us a quick presentation about how his refrigerator had broken. He quickly got us thinking about failure analysis, life expectancy of parts versus their cost, and ease of repair before teaching us about designing good robot components which used the very same principles. One day he explained how the parking lot gate had failed and hit his car earlier that day, and then asked us to think about the risks of a gate failure. A different day it was a quick summary of why the blackouts in Texas had been happening and the costs and importance of energy infrastructure and potential future infrastructure advancements. He took every opportunity he had to make sure we were developing an engineering intuition asking us to investigate and analyze our robot failures and design just like he had done with real-world issues.

Another amazing part about being in Dr. Simmons's class was his multiple research projects that he wanted us to be involved in. He was always mentioning a project about solar powered buildings or educational electric scooters for middle school students. It was never just a mention of something cool he was doing alone, it was always an invitation for us to be involved in a research team or an effort to help others with our engineering skills. I regret not taking him up on some of those opportunities because I would see him meeting with my classmates before or after lab, discussing problems and solving them together.

Dr. Simmons knew all his students by name and organized group projects and teams so that every student learned as much as they could individually. He would split up teams on group projects so that each person could learn from the others and work together to get the objective done. In my five years at Tech in the ME program I have never been a part of a team where each of us learned so much over the semester. Much of this learning is due to Dr. Simmons organization of teams and lab sessions where he offered quick tips about fundamentals catered to each team individually. In recent semesters I have come to see him as a mentor and friend, and he is always offering to help me learn more and connect me with labs I may enjoy working with. I cannot think of anyone better to represent the best in lab instructors and receive the Innovation and Excellence in Laboratory Instruction Award.

Sincerely,

Sam Bass