

**Nomination for the 2024 Curriculum Innovation Award**

**Francesco Fedele**

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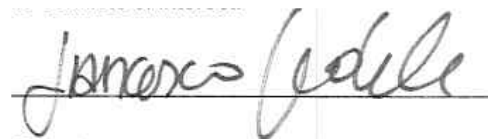
Feb. 12, 2024

Dear Selection Committee:

Please consider the group nomination of female artists Emily Vickers, Rachel Grant, Anna Doll, Jerushia Graham and myself for the *2024 Curriculum Innovation Award* for the creative and innovative Special Topics Course “Visual Arts and Geometry”, initiated and taught for the first time in Fall '18. The artists were appointed as instructional associates at Georgia Tech for the semester during which they co-taught the class with me.

Please do not hesitate to contact me if further information is desired.

Sincerely

A handwritten signature in black ink that reads "Francesco Fedele". The signature is written in a cursive style and is positioned above a horizontal line.

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*Francesco Fedele*, PhD  
Associate Professor  
School of Civil & Environmental Engineering  
Georgia Institute of Technology  
Atlanta, Georgia, USA

## **An educational model to integrate Arts in STEM classrooms**

*Francesco Fedele*

and

*Emily Vickers, Rachel Grant, Anna Doll, Jerushia Graham*

### **Background and Course Overview: A Journey from Recovery to Innovation**

In 2016, following a serious injury, my path to recovery led me to self-taught art therapy through drawing and painting. Rediscovering Pablo Picasso's cubism during this transformative period inspired my early artworks. As art became integral part of my life, I envisioned sharing this experience with my engineering students, aiming to broaden their perspective on science and engineering through the lens of an artist.

The course I created, "Arts and Geometry," introduces engineering students to manifold geometry, exploring shapes from cylinders to crumpled paper. It delves into how these concepts influenced Picasso's cubism and Einstein's relativity, emphasizing a new way of seeing and thinking. The course is integrated with weekly art labs taught over the years by Atlanta professional artists [Emily Vickers](#) (Fall '18), [Rachel Grant](#) (Fall '19,'21,'22) [Anna Doll](#) and [Jerushia Graham](#) (Fall '23). The artists teach students the fundamentals of several art mediums: [pencil and charcoal drawing](#), printmaking, [oil painting](#) and sculptures (see Figures 2-11). Co-teaching with an artist at Georgia Tech exemplifies a model to integrate arts into STEM, fostering innovation at the crossroads of art, science, and technology. [The syllabus can be viewed here.](#)

The artists were appointed as **instructional** associates at Georgia Tech for the semester during which they co-taught the class with me.

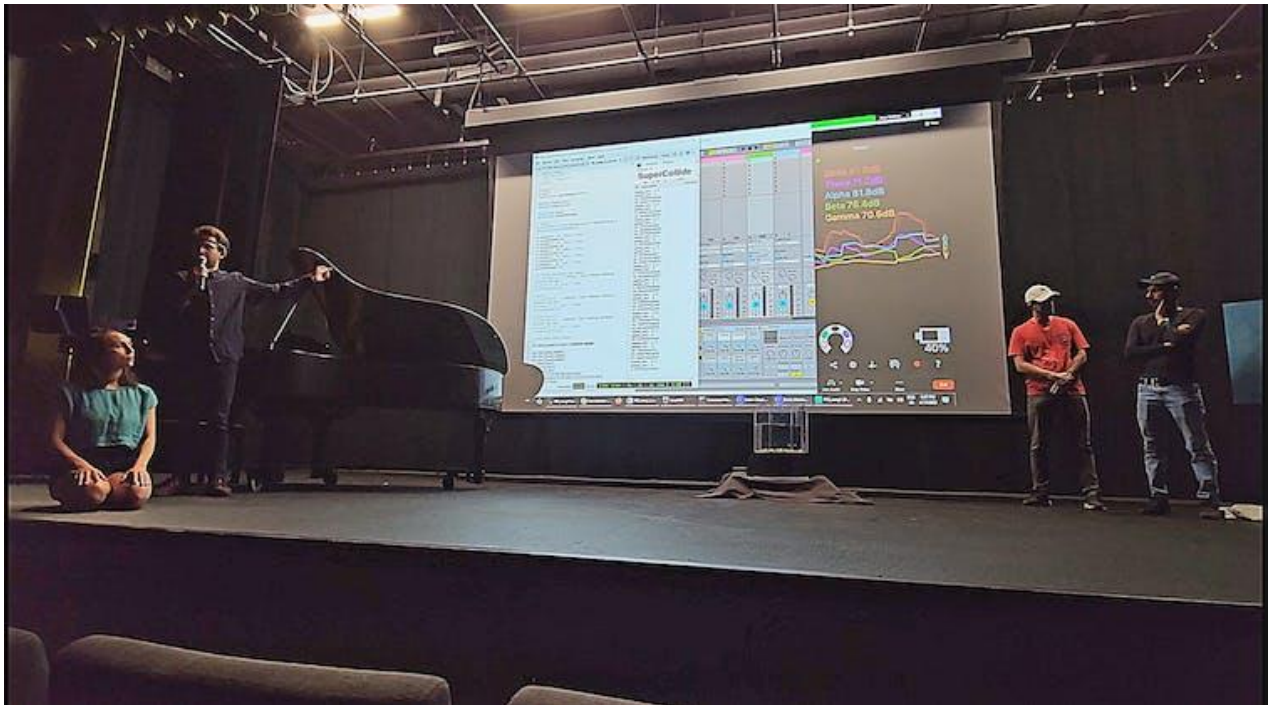
In 2021, together with Artist Rachel Grant, we received *the Class of 1934 CIOS Honor Roll Award* for the 'Arts & Geometry' course. In 2022, we also received the *CEE Senior Faculty Teaching Award*.

Taking innovation further, we also integrate **Electroencephalogram (EEG) technology** into the classroom, teaching students to create performing art using their brainwaves. Brainwaves, measured by EEG headsets, transform into auditory or visual representations, connecting art creation with mental activity (See Figure 1). This unique blend of art and neuroscience enhances critical thinking skills. For example, brainwaves produced by a dancer can be transformed into musical sounds, an auditory representation of the dancer's movements. Similarly, the brainwaves of an artist making a painting, or those of a mathematician deriving an equation, can be transformed into music that mirrors the act of creating art or math.

## Relevance in Today's Evolving World

In our fast-paced world with breakthroughs in AI, quantum computing, and understanding the universe, traditional engineering teaching based on the 17<sup>th</sup> century calculus of Newton and Leibniz often overlooks 20<sup>th</sup>-century mathematical tools by geniuses like Elie Cartan and Einstein. The course bridges this gap, empowering students to unveil hidden geometric structures of large data sets and their analysis.

Beyond academics, students realize the mental health benefits of art practice, gaining confidence and self-esteem. Live performances stimulate creativity, improvisation, and free thinking, preparing students to approach 21st-century engineering challenges with an artistic mindset. The challenges encompass sustainable infrastructure design, global warming mitigation, quantum computing, cybersecurity, and ethical AI use. This course serves as a creative hub, preparing students to confidently tackle the interdisciplinary quests of the 21<sup>st</sup> century.



**Figure 1:** Students Dennis Frank, Muhammad Mustafa and Alexander Zimmer performing brain art. In the background, software converts student performers' brainwaves into music and water turbulence in a tank. The shape and motion of vortices generated by [turbulence](#) are a dynamic visualization of the human mind's activity.

## Teaching performance

Semester	Course #	Course Name	Artist	Enrolled	Responded	Teaching Effectiveness
Fall 2023	CEE 8824-A	Arts & Geometry	Anna Doll Jerushia Graham	17	11	<b>4.60</b>
Fall 2022	CEE 8823-B	Arts & Geometry	Rachel Grant	18	11	<b>4.79</b>
Fall 2022	CEE 8823-B1*	Arts & Geometry	Rachel Grant	19	9	<b>4.93</b>
Fall 2021	CEE 8823-B	Arts & Geometry	Rachel Grant	15	9	<b>4.94</b>
Fall 2021	CEE 8823-B1*	Arts & Geometry	Rachel Grant	15	11	<b>4.89</b>
Fall 2019	CEE 8824-A	Arts & Geometry	Rachel Grant	12	11	<b>4.89</b>
Fall 2018	CEE 8823-A	Arts & Geometry	Emily Vickers	14	11	<b>4.60</b>

\* lab sections

## Assessing Impact: Learning Science and Validation

In collaboration with learning scientists from the Center of 21st Century Universities (C21U) at Georgia Tech, I conducted a comprehensive evaluation of the "Arts and Geometry" course's impact on students' creativity. The study, outlined in a forthcoming publication (Yilmaz Soylu et al. 2023, [view also manuscript draft here](#)), will be presented at the 2024 STEAM Leadership Conference (Yilmaz Soylu et al. 2024). The research employed a sequential explanatory mixed-method research approach. The key findings highlighted that

- *Collectively, both quantitative and qualitative results underscored a noteworthy improvement in students' creativity following their participation in the graduate-level STEAM course.*
- *The course effectively stimulated students' imagination and enhanced their visual skills through drawing and painting, fostering a deeper understanding of the abstract notions inherent in modern geometry.*

This research underscores the positive influence of integrating arts into STEM education, emphasizing the tangible benefits observed in students' creativity, imagination, and grasp of complex geometric concepts.

## References

- 1) M. Yilmaz Soylu, Jeonghyun Lee, S. W. Harmon and F. Fedele 2024. Brushes and Formulas: Investigating Creativity in a Graduate STEAM Course. *2024 STEAM Leadership Conference*, Atlanta March 8-9, 2024.
- 2) M. Yilmaz Soylu, J. Lee, F. Fedele, R. Grant and S. W. Harmon (2024) Picasso and Einstein in the classroom: Examining creativity in a cross-disciplinary STEAM course, *Journal Thinking Skill and Creativity (under review)*
- 3) Fedele F., Vickers E. 2018 "[Like Picasso and Einstein: lines, forms and dimensions](#)" Art book magazine describing outcomes of the Special Topics Course "Arts and Geometry" taught in Fall 2018.
- 4) Fedele F., Grant R. 2021 "[Forms and Expression: Artistic Lines from Analytical Minds](#)" Art book magazine describing outcomes of the Special Topics Course "Arts and Geometry" taught in Fall 2019.

## Diversity, Equity, Inclusion and Global Outreach

The universal nature of the arts forms the cornerstone of my initiatives at Georgia Tech, fostering inclusivity and empowerment for students across diverse racial, ethnic, and gender backgrounds in fields historically underrepresented in the academic landscape. Notably, the impact of these initiatives extends beyond the classroom:

1. **Student Empowerment:** Students who have engaged with my courses found inspiration, leading some to pursue degrees in both arts and technology. This underscores the transformative potential of art in nurturing diverse talents.
2. **Supporting Female Artists in Academia:** The collaborative teaching experience involving four female artists presents a significant opportunity to encourage their entry into academia and pursue teaching careers. Encouragingly, two of these artists are actively seeking teaching positions at Art Schools in the Atlanta Area.
3. **RobotArts Initiative:** As the Principal Investigator of the *RobotArts Initiative*, I am driving efforts to bridge the gap for Colombian university students interested in arts and engineering (robotics). The international initiative focuses on increasing the number of skilled Latino students in engineering (robotics) and arts from the *Universidad del Valle*, and *Universidad Pedagogica Tecnologica de Colombia*. The "Arts & Geometry" course, taught in hybrid mode during Fall '21, '22, and '23, plays a pivotal role in supporting the Virtual Exchange and STEAM Experience for Colombian students. This initiative culminates in a cultural and artistic exchange, enriching the educational journey of both Georgia Tech and Colombian students. Robotarts is funded by the Denning Seed Fund Award and 100kStrongAmericas.

These initiatives collectively underscore a commitment to diversity, equity, and global engagement, creating pathways for underrepresented students and artists to thrive in the intersection of arts, technology, and engineering.

## Looking ahead and beyond: Educational Model Expansion

1. **Agile Artist In-Residence Program:** Establish a dynamic artist in-residence initiative to horizontally integrate arts into STEM courses and potentially extend the ROBOTARTS initiative to include CLIMATE and AI. This program aims to attract professional artists and art educators from underrepresented groups in both the Atlanta area and Colombian universities involved in ROBOTARTS. These individuals will serve as instructional associates for a semester or longer. Faculty will be provided access to a curated collection of art modules designed and delivered by these artists, offering flexibility in module design, including one-time events or recurring activities like weekly labs.
2. **Creative Graduate Courses and Certificate Program:** Develop a foundational set of creative graduate courses to establish the groundwork for launching an Arts & Engineering Certificate Program. This certificate program aligns with Georgia Tech's new "lifetime learning" school unit, promoting interdisciplinary education and lifelong learning.

3. **Interdisciplinary Collaboration with Psychology:** Cultivate collaboration with the School of Psychology to initiate a pilot graduate program at the intersection of Engineering Sciences, Liberal Arts, and Neurosciences. This collaboration will include groundbreaking research on EEG technology to enhance classroom teaching, measure students' learning progress, and amplify their creativity.
4. **EEG-Based Neuroscience-Art-Engineering Curriculum:** Explore the insights gained from students' brainwaves regarding their creativity and leverage this information to provide valuable feedback. Develop a comprehensive EEG-based Neuroscience-Art-Engineering Curriculum, emphasizing the fusion of technology, arts, and neuroscience. Additionally, plan for EEG-based Teacher Training to equip educators with the skills to leverage new technologies effectively, optimizing their teaching methods in the classroom.

These proposed initiatives aim to advance interdisciplinary education, foster diversity, and utilize cutting-edge technologies to enhance the learning experience at Georgia Tech.

### **Student success activities and achievements in Liberal Arts**

The course has sparked collaboration between students and faculty in the pursuit of arts. Students showcased their artwork and presented brain art at the Atlanta Science Festival and Science.Art.Wonder. Additionally, students have showcased their artwork marking the completion of the course. Below is a list of student success activities and their involvement in art events.


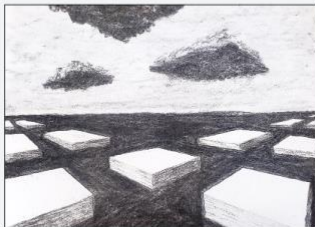
1. Atlanta Science Festival, Piedmont Park Atlanta, March 2023, **“EEG technology & Art”** and **“Brain Turbulence”**: fluid mechanics of turbulence and EEG technology to explore the 'shape' of our thoughts in the form of realistic vortical flows and music created by our own brain waves while we make art. Turbulence system designed by Professor Chris Lai and *students Muhammad Mustafa and Alexander Zimmer*. *EEF Tech designed by students: Dennis Frank, Tanisha Chanda*.
2. Science.Art.Wonder Campus student brain art performance, April 17, 2023: **“Mind Blues”** at the Atlantic Theater of the Georgia Tech Student Center. A fusion of dance, painting, brain music, and piano using EEG technology. *Performing students: Dennis Frank, Tanisha Chanda*. [[YOUTUBE](#)]
3. Science.Art.Wonder Campus student brain art performance, April 17, 2023: **“Brain Turbulence”** at the Atlantic Theater of the Georgia Tech Student Center. A fusion of dance, fluid mechanics, and music. Students explored the fluid mechanics of turbulence and EEG technology and visualize brainwaves as realistic vortical flows. Turbulence system designed by Professor Chris Lai and *students Muhammad Mustafa and Alexander Zimmer*. *Performing students: Dennis Frank, Tanisha Chanda*. Choreographer: Bella Dorado. [[YOUTUBE](#)]
4. Student artwork exhibition for the Special Topics Course “Arts & Geometry: **“Harmony in Mind”** Student Art Exhibit on Dec 19, 2023, at Mason Building, Georgia Tech, Atlanta, marking the completion of the Special Topics Course “Arts & Geometry.” [[YOUTUBE](#)]

5. The art & geometry course was featured in TheConversation: [This-engineering-course-has-students-use-their-brainwaves-to-create-performing-art ~ \( 5000 views\)](#)
6. “Exploring Minds: *An exhibition of Painting, Drawing, Printmaking and Brain Art*” Student Art Exhibit Dec 12 2022 at Mason building, Georgia Tech, Atlanta in completion of the Special Topics Course “Arts & Geometry” [\[YOUTUBE\]](#)
7. Public Lecture in Physics: F. Fedele and R. Grant “**Picasso and Einstein in the classroom, unlocking students’ creativity**”, October 10, 2022, Clough Undergraduate Learning Commons, Georgia Tech
8. [ELEVATE](#) screened the Dance Film "**GLITCH: Escaping Plato's cave**" on Sept 16, 2022 at CODA Tech Square, Atlanta, GA. The dance performance and film explored the universality of human vulnerability and strength inspired by Plato's allegory. ELEVATE is a public art program that seeks to invigorate the Atlanta Area through visual art, performances, and cultural events.
9. Atlanta Science Festival, Piedmont Park Atlanta, March 2022. [“EEG technology and art”](#) EEG technology developed by student Dennis Frank.
10. Science.Art.Wonder Campus Exhibit April 8, 2022: “**Mind Melody**” in the Hodges Room of the Centergy Building on Georgia Tech’s Campus. “Mind Melody” is a brain art performance of dance, painting, and geometry. It fuses art and EEG technology to explore brainwaves as inspiration for visual art, music, and movement. Performing students: Dennis Frank. [\[YOUTUBE\]](#)
11. “**Expressions of Analytical Minds**” Student Art Exhibit Dec 14 2021 at *Mason building, Georgia Tech*, Atlanta in completion of the Special Topics Course “Arts & Geometry” [\[YOUTUBE\]](#)
12. “**Form and Expression: Artistic lines from analytical minds**” Student Art Exhibit Dec 11 2019 at *Mason building, Georgia Tech*, Atlanta in completion of the Special Topics Course “Arts & Geometry” [\[YOUTUBE\]](#) [\[Art Book Magazine\]](#)
13. Science.Art.Wonder Campus Exhibit March 24-26, 2021 Dance performance (film) "**GLITCH: Escaping Plato's cave**" in collaboration with DanceCanvas Chorographer Thulani Vereen, at Bill Moore Student Success Center, Georgia Tech. The dance performance and film explored the universality of human vulnerability and strength inspired by Plato's allegory. GLITCH was screened in 2021 at ‘SOAR’ Presented with BronzeLens Film Festival, Synchronicity Theatre.
14. “**Like Picasso & Einstein: lines, forms and dimensions**” Student Art Exhibit Dec 11 2018 at *Kai Lin Art Gallery*, Atlanta [\[Art Book Magazine\]](#)



<p>The Georgia Tech Ferst Center for the Arts proudly presents</p> <p style="text-align: center;"><b>Like Picasso and Einstein</b> Lines, Forms and Dimensions</p>  <p>Featuring the artwork of students of the Georgia Tech course "Visual Arts and Geometry": Omar Alrawi, Erik Anderson, Bahar Asgari, Dennis Frank, Ashish Gupta, Ramyad Hadidi, Joonho J. Kim, Kelsey Kurzeja, Jiixin Li, Xiaoyu Li, Yoon Joo Na, Ranjita Kasturi, Tianhui Zhao, Weipeng Zhuo</p> <p style="text-align: center;"><b>Tuesday, December 11<sup>th</sup>, 2018</b> 6:00 – 10:00 PM</p> <p style="text-align: center;">At Kai Lin Art Gallery 999 Brady Avenue NW, suite 7, Atlanta</p>	<p>The Georgia Tech School of Civil &amp; Environmental Engineering proudly presents</p> <p style="text-align: center;"><b>Form and Expression</b> Artistic Lines from Analytical Minds</p>  <p>Featuring the artwork of students of the Georgia Tech course "Visual Arts and Geometry"</p> <p style="font-size: small;">Artists: Santana Farrington Alton, Kayla Marie Allen, Carter Owen Culwell, Eli Grant Derrington, Barry Goodno, Sakshi A Hattargi, Fatima Javeed, Shasha Liao, Joshua William Martin, Emily Daniels Sanders, Aleksanteri Benjamin Vattulainen, Pengxiao Xu, Weiwei Zhang</p> <p style="text-align: center;">Opening Reception 5-8 pm Dec 11, 2019 Mason building 790 Atlantic Drive, Atlanta</p>
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**Figure 2:** Flyers of student art exhibits in Fall '18 and '19.

<p>The Georgia Tech School of Civil &amp; Environmental Engineering proudly presents</p> <p style="text-align: center;"><b>Expressions of Analytical Minds</b></p>  <p>Featuring the artwork of students of the course "CEE8823 Visual Arts &amp; Geometry"</p> <p style="text-align: center;">Instructors: <i>Francesco Fedele &amp; Rachel Grant</i></p> <p style="font-size: small;">Artists: Julia Bush, David Bustamante, Madeline Buxton, Isabelle D'amico, Griffin Fish, Mehdi Harley, Oscar Higuera-Martinez, Ziji Liao, Mumtaz Luthfi, Daniel Martinez, Christian Perez Castillo, Krishma Singal, Attallah Smith, Guotong Song, Paola Vargas-vargas, Anqi Wei, Alexandra Wu, Luis Mathias Zacarias</p> <p style="text-align: center;"><b>5-8 pm Dec 9, 2021</b></p> <p>5:00-pm - Opening Reception 5:30-pm - Artist Talks 6:30-pm - "Brainwaves in Music: Contemporary Trends" by Mike Winters, Microsoft Research 6:40 pm - Brain Art 'Primordial Harmony'</p> <p style="text-align: center;">Mason building, 790 Atlantic Drive, Atlanta</p>	<p>The Georgia Tech School of Civil &amp; Environmental Engineering proudly presents</p> <p style="text-align: center;"><b>Exploring Minds</b> An Exhibition of Drawing, Painting, Printmaking, and Brain-Art</p>  <p>Featuring the artwork of students of the Georgia Tech course "Arts and Geometry"</p> <p style="font-size: small;">Artists: Katherine Booth, Marion Xuan Cassim, Qingyu Chen, Yanan Chen, Haochuan Feng, Seyma Gurkan, Hongbo Hu, Xuejing Ji, Yuqi Jia, Manik Ketan Rambahia, Tiannuo Ren, Haodan Tan, Linli Tang, Shuhan Yang, Chenyang Zhang, Shiyu Zhang, Wenxi Zhang, Xiaoyue Zhang</p> <p style="text-align: center;"><b>Opening Reception 5-8 pm Dec 12, 2022</b> <i>Artist talk 6pm</i> <i>Brain Art demonstration 7pm</i></p> <p style="text-align: center;">Mason building, 790 Atlantic Drive, Atlanta</p>
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**Figure 3:** Flyers of the student art exhibits in Fall '21 and '22.

The School of Civil & Environmental Engineering and DESIGN BLOC of the College of Design at Georgia Tech proudly present

# Harmony in Mind

## Lines, Forms and Brainwaves



Featuring the artwork of students of the Georgia Tech course  
*"Arts and Geometry"*

Artists: Alyssar Ahmadie, Jhonatan Alvarez Rodriguez, Julian Casarella Cunningham, Laura Vanesa Delgado Gama, Sebastian Escobar Topa, Sandy Huynh, Farrah Khanpour, Fan Shu, Yufeng Su, Andriz Vegas Lopez, Zhiyu Wan, Cenchao Wang, Zeyu Wang, Xinhan Yang, Alexander Michael Zimmer, Kyle Conrad Zimmermann

Opening Reception 3-6 pm Dec 7, 2023  
Artist talk 4 pm

Mason building, 790 Atlantic Drive, Atlanta

**Figure 4:** Flyers of the student art exhibit in Fall '23



**Figure 5:** The 2018 student art exhibit at the Kai Lin Art Gallery of Atlanta.



**Figure 6:** Fall 18'. Student **Bahar Asgari**, School of Electrical and Computer Engineering: (left) *Gravity* (pencil on paper, 11x14") (right) *Time Vertigo* (Acrylic on gesso board, 16x20")



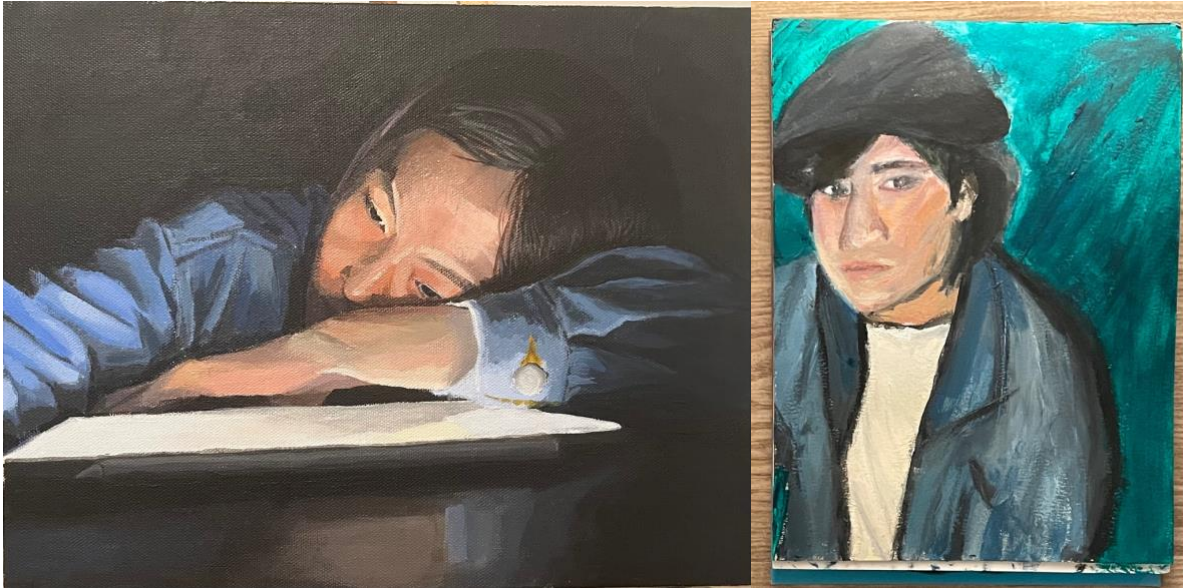
**Figure 7:** Fall '18. student **Erik Anderson**, School of Mechanical Engineering: (left) *Portrait No. 1* (Charcoal on paper, 11 × 14") (right) *Jellyfish* (Pencil on paper)



**Figure 8:** Fall '21, self-portraits by students (left) Mathias Zacarias (CEE) and Isabelle d'Amico (CEE) (oil on canvas).



**Figure 9:** Fall '21, self-portraits by students (left) Attallah Smith (CEE) and Guotong Song (CEE) (oil on canvas).



**Figure 10:** Fall '23, self-portraits by students (left) Wan\_Zhiyu and Julian Cunningham (oil on canvas).



**Figure 11:** Fall '23, self-portrait by student (left) Sebastian Escobar Topa (oil on canvas) and (right) sculpture by student Wan\_Zhiyu

To whom it may concern:

After taking the Special Topics course, CEE8824 “*Visual Arts and Geometry*” co-taught by professional artist Rachel Evans and Dr. Francesco Fedele, we, the students, recommend that the administration support Dr. Fedele’s unique effort to diversify the learning experience at Georgia Tech by incorporating visual arts into the curriculum and that the course become permanent. To support our recommendation, we share some of our experiences in the course that highlight how the connection between engineering and art can significantly enhance our technical pursuits as engineers.

We begin by elaborating on the nature of the course, which provided a stress-free environment in which to enhance our engineering, mathematical, and drawing skills. Typically, engineering is taught formulaically, with clear right and wrong solutions, whereas art is taught by guiding students to work from within and harness complete freedom to create. In CEE8824, we experienced a synergy of these two styles: the course was divided into an engineering/mathematics portion led by Dr. Fedele and a drawing portion led by Rachel Evans. In this way, *the drawing portion helped to enhance learning in the math portion of the course, and vice versa*. For example, in both portions of the course, we learned that it is important to understand the big picture before diving into the details. In drawing, we did short gesture drawings that captured only the essential elements, as a way to fully understand the subject before focusing intently on the details. In engineering/mathematics, we learned through sketching the scenario and deriving key equations to fully understand the problem before pursuing any algebra to reach a solution. Further, the course emphasized creative thinking in both the art and math portions, an activity that is often lost in traditional engineering courses. Lastly, we would like to emphasize that the course is not an art course with geometry in the title simply to justify its existence in the engineering curriculum. In fact, we studied deep mathematics and physics concepts (e.g., differential geometry of manifolds, special relativity, and general relativity) that exposed us to knowledge that many of us had not seen in our prior engineering courses.

In the setting described above, we gained confidence and were empowered to create. Most of us had little drawing experience at the start of the course, yet all of us found success in putting observation on paper during the course. The trajectory to success in drawing has clear parallels to the trajectory to success in engineering/mathematics. In both cases, only after mastering some fundamentals (e.g., proportion in drawing, mechanics in engineering) can you become free to create new ideas. *Through our success in the drawing portion of the course, we are empowered to go beyond the fundamentals of engineering and create new ideas that can potentially have lasting impacts on our society.*

As students, we particularly appreciated the passion of the instructors, the opportunity to learn out of curiosity rather than through the pressure of grades, and a space for discovering (or re-discovering) talents that may have been stifled previously or that we didn’t know we had. One of the most rewarding parts of the course was the figure drawing sessions at the Atlanta Artists Center, which provided a totally different environment than we are used to at Georgia Tech and helped us break out of our comfort zones. Additionally, *figure drawing helped us develop critical thinking skills in observing and engaging with the world around us*, which are skills that enabled great minds, like Leonardo da Vinci, to gain a deep understanding of the physics of our world and to explain it in a meaningful way (visually).

Georgia Tech has recently expressed its commitment to art and sent out a survey about students' engagement with the arts; however, there are few attempts at deeply integrating art into the curriculum beyond small, once-a-semester art showcases and outside performers at the Ferst Center. The creative course co-taught by Dr. Fedele and professional artist Rachel Evans helps fill a void in the Georgia Tech engineering course offerings. It has empowered us to create, to try new things, and to engage with people that think differently. Based on feedback from our colleagues outside of the course, it is likely that enrollment will increase as more students learn about it. CEE8824 was powerful at the graduate level, and by infusing these ideas earlier in the engineering student's career (e.g., at the undergraduate level), perhaps the outcome will be even greater.

Sincerely,

Santana Afton

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Kayla Allen

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Carter Culwell

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Eli G. Derrington

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Barry Goodno

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Sakshi Hattargi

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Shasha Liao

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Joshua Martin

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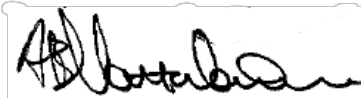
Emily D. Sanders

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Aleksanteri B. Vattulainen

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Pengxiao Xu

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We begin by elaborating on the nature of the course, which provided a stress-free environment in which to enhance our engineering, mathematical, drawing, and painting skills. Typically, engineering is taught formulaically, with clear right and wrong solutions, whereas art is taught by guiding students to work from within and harness complete freedom to create. In CEE8823, we experienced a synergy of these two styles: the course was divided into an art history portion and an engineering/mathematics portion led by Dr. Fedele and a drawing and painting portion led by Rachel Evans.

The structure of the course emphasized freedom of thought by putting aside the constraints we impose on ourselves and looking at the big picture before rushing into the details. The objective of this style of teaching is to relax our rigid expectations that might get in the way of understanding more abstract and difficult to visualize concepts. Additionally, in freeing our thinking, we seek to expand our creativity and be able to see and make connections between different concepts that might seem disparate, making it easier to correlate distinct mathematical concepts, and encouraging innovation through the intersection of different fields. For example, we did short gesture drawings to learn how to represent the object or the figure with only minimal elements. Having captured the essentials of our figures, we then built up the details using a variety of skills and tools learned in the course. In the drawing and painting portion we also learned the importance of observing the world and notice the small details that are otherwise taken for granted. By observing and deconstructing the subject in our minds, seeing how the surfaces interact with light, and the essential shapes, we learn more about the subject and the world. This strict scrutiny and observation is a skill that directly applies to learning any other topic. In engineering/mathematics, we learned through sketching the scenario, visual demonstrations, and deriving key equations to fully understand the problem before pursuing any algebra to reach a solution. We would like to emphasize that the course is not an art course with geometry in the title simply to justify its existence in the engineering curriculum. In fact, we studied deep mathematics and physics concepts (e.g., differential geometry of manifolds, special relativity, and general relativity) that exposed us to knowledge that many of us had not seen in our prior engineering courses.

In both portions of the course, we learned about famous historical figures who revolutionized their fields (namely Picasso and Einstein). In examining the similarities between these figures, we were able to learn how science and art complement each other to lead to new innovations. These lessons paired with the objective of expanding our creativity, encourages us to keep a mindset of innovation to better be able to contribute to the world through our work as engineers.



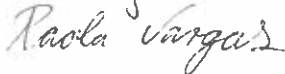
The art portions also enhanced our motivation and interaction with the class. Through drawing and painting together and sharing our thoughts and growth while expressing ourselves, we formed a closer connection to our classmates and our instructors that kept us more invested in the course. Paired with the unrivaled enthusiasm and passion of the instructors, it made this course a very positive and engaging experience that enriched our experience as students at Georgia Tech. Indeed, the ability to learn technique from a professional artist as well as geometry and applications from an engineering professor made for an experience not many of us students have ever had before. Crucially, Rachel Evans had the unique task of nurturing creativity and artistic skill in science-oriented students, and her charisma and teaching style augmented our growth as artists and free thinkers.

Georgia Tech has expressed its commitment to art; however, there are few attempts at deeply integrating art into the curriculum beyond small, once-a-semester art showcases and outside performers at the Ferst Center. The creative course co-taught by Dr. Fedele and professional artist Rachel Evans helps fill a void in the Georgia Tech engineering course offerings, and we encourage more courses to incorporate art and creativity into their curriculums. It has empowered us to create, to try new things, and to engage with people that think differently. Based on feedback from our colleagues outside of this course, it is likely that enrollment will increase as more students learn about it. CEE8823 was powerful at the graduate level, and by infusing these ideas earlier in the engineering student's career (e.g., at the undergraduate level), perhaps the outcome will be even greater.

Signed,

Students of CEE 8823, Fall 2021

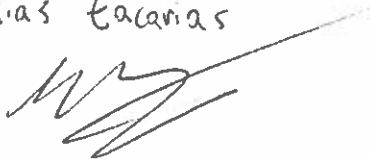
Paula Vargas



Isabelle D'Amico



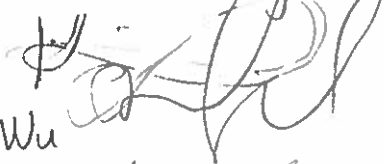
Mathias Zacarias



Daniel Enrique Martinez



Krishma Singal



Xiaofeng Wu



Attallah Smith



Margelina Buxton



Amobang Song

Mehdi Haricy



Griffin Fisk



Julia Bush

Mehdi Buxton  
MUMTAZ LUTHFI





January 30, 2024

Dear Committee Members,

I am writing to wholeheartedly endorse the group nomination of Dr. Francesco Fedele and professional artists Emily Vickers, Rachel Grant, Anna Doll, and Jerushia Graham for the 2024 Curriculum Innovation Award. Their collaborative efforts have significantly contributed to creative and innovative educational initiatives within the School of Civil & Environmental Engineering.

Dr. Fedele's initiation of the "Arts and Geometry" Special Topics Course in Fall '18, and its continuation every Fall semester since, showcases a pioneering approach to engineering education. The course introduces students to manifold geometry, linking it to modern art and science influences such as Picasso's cubism and Einstein's relativity. Weekly art labs, led by professional artists, expose students to diverse artistic mediums, creating a unique interdisciplinary learning environment.

The artists were appointed as instructional associates at Georgia Tech for the semester during which they co-taught the class with Dr. Fedele. All the Artists have played a pivotal role in the course's success and course improvement over the years. In recognition of their outstanding contributions, Dr. Fedele and Artist Rachel Grant received the Class of 1934 CIOS Honor Roll Award in 2021 and the CEE Senior Faculty Teaching Award in 2022.

The course's impact extends beyond traditional boundaries, incorporating EEG technology to teach students to create performing art through brainwave representation. Dr. Fedele's collaboration with learning scientists from Georgia Tech's Center for 21st Century Universities (C21U) further highlights the course's commitment to assessing its influence on students' creativity.

Student success activities resulting from the course are noteworthy, with students actively participating in arts events such as the Atlanta Science Festival and Emory-Georgia Tech Science.Art.Wonder. Engaging in the arts has not only enhanced students' mental well-being but also prepared them to approach 21st-century engineering challenges with an artistic mindset.

Dr. Fedele's art initiatives also embody a commitment to diversity and inclusion, empowering underrepresented students in arts and technology. Co-taught by female artists, the course contributes to their entry into academia, supporting applications for teaching positions at Art Schools. Furthermore, the course's alignment with the RobotArts Initiative, funded by the Denning Seed Fund and 100kStrongAmericas, emphasizes its global impact. Dr. Fedele's leadership in this initiative supports cultural exchange through virtual and in-person experiences for Colombian students.

In conclusion, I offer my strong support for the group nomination for the Innovation Curriculum Award. The "Arts and Geometry" course represents an exemplary model of interdisciplinary education and fosters a spirit of innovation and creativity within our academic community.

Sincerely,

Donald R. Webster  
Karen & John Huff School Chair and Professor

January 23, 2024

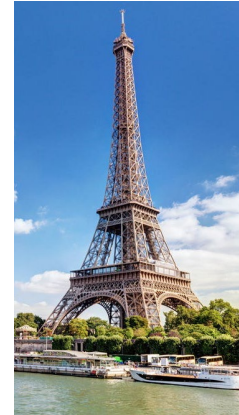
Curriculum Innovation Award Committee  
Georgia Tech  
500 Tech Parkway NW  
Atlanta, GA 30332-0435

**RE: Letter in Support of Curriculum Innovation Award Nomination**

Curriculum Innovation Award Committee,

It is my pleasure to provide this letter of nomination for Dr. Francisco Fedele and professional artists Emily Vickers, Rachel Grant, Anna Doll, and Jerushia Graham in support of them receiving the Georgia Tech Curriculum Innovation Award. Dr. Fedele launched a new course on “Visual Arts and Geometry” which is a highly innovative and original course. This course blends sophisticated analytical thinking with creative expression in ways that engage engineering students deeply in the technical concepts they are learning more broadly in the engineering curriculum. It has been a career-long concern of mine that we spend so much time in the engineering curriculum training students to think analytically, that we make it difficult for those same students, after they graduate, to engage in what brought them to engineering in the first place... to design, engineer and build infrastructure that can inspire.

The course this group created uniquely requires students to merge their technical knowledge toward an aesthetic and creative endeavor. I believe this is the kind of thinking that enabled some of the greatest civil engineers (e.g., Gustav Eiffel (designer of the Eiffel Tower in Paris), Ove Arup (designer of the Sydney Opera House), and Santiago Calatrava (designer of the Milwaukee Art Museum) to design not just functional infrastructure, but infrastructure that can surprise, astonish, and inspire. We need to prepare our Georgia Tech engineering graduates to stand out and lead among their engineering peers upon graduation, this course has become an important step in that direction.



The feedback from students who have taken the course supports the impact it is having on them. They describe the course as “filling a void” in our engineering course offerings, offering them the opportunity to “create, to try new things, and to engage with people that think differently.” I very strongly support Dr. Fedele and his collaborators receiving the Georgia Tech Curriculum Innovation Award.

Sincerely,



John E. Taylor  
*Frederick Law Olmsted Professor*  
*Associate Chair for Faculty Development and Research Innovation*