# Weaving the Branches: A Perspective Relating a Foundation in the Humanities to Success in Scientific Education

Bryan J. Hlavinka[1,2]

[1]Department of Biology & Biochemistry, University of Houston, Science & Research Building 2, 3455 Cullen Blvd., Houston, TX 77004 USA

[2]Curran's Nanophysics Research Group, University of Houston, Science & Research Building 1, 3507 Cullen Blvd., Houston, TX 77204 USA

> *"All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man's life, lifting it from the sphere of mere physical existence and leading the individual towards freedom."—Albert Einstein*

(Editor's note: Author's autobiographical vignettes appear indented throughout this article.)

**Abstract**

Undergraduate STEM (Science, Technology, Engineering, Mathematics) culture often treats the humanities as peripheral to scientific success, yet evidence suggests that interdisciplinary training fosters stronger communication, creativity, and adaptability—skills crucial in research and, in the case of aspiring physicians, clinical practice. As a postbaccalaureate/premedical biochemistry student with a degree in the creative arts, I have found that my liberal arts background provides essential tools for navigating the scientific world; from mastering complex biochemical pathways to communicating effectively with faculty, securing mentorship, and forming collaborative learning communities. My prior decade-long career in marketing, involving extensive nationwide travel, further enhanced interpersonal fluency and professional communication. This perspective piece integrates personal experience with expert scientific and sociological literature to argue that humanities training offers structural advantages in STEM learning, bureaucratic navigation, and medical preparation. I demonstrate how storytelling, artistic cognition, and interpersonal

communication support scientific reasoning, scholarship applications, research involvement, and patient-centered thinking. Other, more individually subjective factors like age or maturity and lived experience cannot be disregarded as factors in achieving academic success for postbaccalaureate students. As medical schools increasingly embrace holistic admissions and diverse educational backgrounds, my experience illustrates the value of broad academic foundations in shaping resilient and well-rounded scientists and future clinicians. Critically, the teaching methods for scientific disciplines sharply diverge from those related to a general liberal arts education while both share common ground in critical thinking, problem solving and constructing knowledge from elementary principles. By integrating narrative lived experience with educational research, I present a case study demonstrating the value of interdisciplinary training in scientific education. Ultimately, this paper argues for a more integrated STEM education model that recognizes humanities competencies as assets rather than detours.

**Introduction**

> *"It is the struggle itself that is most important. We must strive to be more than we are. It does not matter that we will not reach our ultimate goal. The effort itself yields its own reward."—Gene Roddenberry*

STEM education in the United States continues to expand in rigor, specialization, and competitiveness, yet it frequently dismisses the humanities as tangential to scientific practice or flippantly disregards the value of humanities training altogether. Students entering biochemistry, neuroscience, physics, or premedical training from "nontraditional" academic backgrounds often feel pressure to justify their place in the laboratory or lecture hall. I experienced this firsthand when returning to university as a postbaccalaureate student. Instead of beginning with calculus or general chemistry, my academic identity was rooted in storytelling, visual reasoning,

and artistic critique. However, I discovered that these humanities-driven skills are inherently linked with the cognitive, communicative, and interpersonal demands of scientific training.

A growing body of educational research supports this idea:. Interdisciplinary learning enhances creativity, improves conceptual integration, and strengthens problem-solving abilities [14]. Medical education, likewise, is shifting toward holistic admissions that value applicants with diverse academic histories, recognizing that qualities such as empathy, "cultural competence," oral and written communication, resilience and adaptability are foundational to effective clinical practice [2]. While STEM and the humanities are often framed as being in a contentious "culture war" [12], this is likely due to the misconception that humanities students lack the cognitive framework for STEM. Importantly, "humanities" and "liberal arts" are used interchangeably in this paper with the caveat that my perspective is influenced by a humanities education centered around the creative arts. This paper argues that humanities training offers structural advantages in STEM learning and medical preparation, using my own transition from the creative arts to biochemistry as a primary case study.

> I grew up in small town in the Coastal Plains of Texas where aspirational opportunities were few. I played sports until they interfered with my garage bands, painted constantly, and obsessed over books. My high school STEM experience was non-existent, though I excelled in anatomy and physiology because I treated it like an art class—studying the body to better paint the human figure. While others struggled with flashcards, I recalled anatomical forms as if they were lines from a favorite novel.
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> I briefly flirted with the idea of pursuing a medical career after enrolling in undergraduate A & P courses, but after researching the level of STEM competency necessary, I succumbed to fear of failure. I believed the lie that I had told myself since I received my one and only C in dual-credit college precalculus—I simply was not good

enough at math to be able to grasp science. Because I enjoyed reading, writing, art and music, I didn't have the brain for it. Instead, I chased scholarships and transferred often, graduating in 2009 with a BA in Creative Writing and a minor in studio art. Entering the workforce during a recession, I went into marketing.

I spent the next decade exploring the United States, accumulating promotions in a relatively lucrative career, eventually rising to the position of Nationwide Experiential Tour Manager for a tequila company. My time on the road taught me the value of communication and how having a diverse range of interests allowed me to connect with nearly everyone I met. It also taught me that the key to being interesting is being interested in what the other person had to say.

In 2016, I fulfilled a lifelong dream of appearing on Jeopardy! [8] During the contestant interview portion of the show, Alex Trebek asked me what I did for a living. I told him, "Basically, I get paid to party." I fully embodied an image that I had built around my lifestyle—a fun person with very little emotional baggage that got to live a life that was envied by his friends. I felt like I was happy because by all metrics I had used to measure contentment, I felt fulfilled, even if I subconsciously knew that this wasn't going to last forever.

Covid-19 obliterated the experiential marketing industry. The fragility of the career I had built had been weighing on me for a few years before the pandemic happened. I felt untethered. I had spent 6-11 months every year on the road, away from the people I cared about at home, and while I had friends in every major city of the country, I felt transient in their lives also. I was unhealthy, heavier than I had ever been and surviving on id—eating almost nothing but fast food and living in hotels. Outside of superficial career benchmarks, there was no accomplishment, no artistic practice, nothing to look

forward to except the next city. I had no balance and no support system for attempting to find it.

Pure serendipity in December of 2019 led me to make healthier choices that fundamentally changed how I saw myself as a person. The alcohol industry had shaped me, but my desire for self-actualization required significant, life-altering choices. I quit drinking because I started working out every day and during the pandemic, began painting commissions again while my career faltered. I found a growing interest in biochemistry and metabolism by researching and adhering to a keto diet. I was listening to Stephen West's "Philosophize This!" podcast between episodes of "Behind the Bastards." I finally had time to read the books that I had been hoarding for years. The forced introspection of the next few months of quarantine had me weighing poignant existential questions: If I was as happy of a person as I thought myself to be, why was my life so much better now that I'd lost every symbol of status I had? What was I if not the person who "got paid to party?" What did I value? Was I a good person? What did it mean for me to be good? If this worldwide shutdown was so terrible, why was my life better now than it had ever been? How could I say that without feeling guilty?

I knew that I wanted to help people and that continuing to market alcohol was antithetical to that. It felt disingenuous to work in an industry that no longer had a place my life. I lost 37% of my overall bodyweight by focusing on my health. I got into therapy. I ran a marathon in January, 2022. I wanted to share what I had gained by prioritizing my wellbeing with the people I loved, but I was continually reminded that I could only help people that wanted to be helped.

In the summer of 2023, while lying on my back in a yoga class. I mentioned to my instructor that my shoulder was injured, and she told me that she could had just

learned a specific adjustment in medical school that could help make it feel better. It was an epiphanic moment—something in that small act of care tied to the mention of medical school generated a slowly-building certainty where my future path would take me.

That long-forgotten, brief flirtation had returned and I finally knew what I wanted to do with my life. All that self-analysis had manifested in an instant with a quote often attributed to the Buddha, "When you realize how perfect everything is you will tilt your head back and laugh at the sky." And there I was in a quiet yoga class, on my back, laughing at the ceiling. I'm sure I looked insane.

Two weeks later, I re-enrolled in my alma mater. I saw that the Venn diagram of prerequisite classes for medical school and the degree plan for a biochemistry major was nearly a circle. But I couldn't just declare Biochemistry my major: I first had to pass calculus.

**The Humanities as Cognitive Training for STEM**

*"Science can tell you how to clone a dinosaur. Humanities can tell you why that's probably not a good idea."—Dr. Jonathan Marks*

My artistic and literary training provided cognitive tools that have unexpectedly strengthened my performance in biochemistry and nanophysics research. Visual art made it easier for me to think in three dimensions and trained my spatial reasoning—directly relevant to comprehending stereochemistry, complex molecular structures, protein conformational changes, and biochemical pathways. Creative Writing, on the other hand, required pattern recognition, narrative synthesis, and precision with language—skills that transfer seamlessly into understanding experimental design, interpreting primary literature, and writing scientific reports.

Scholarly literature supports these parallels. Studies show that scientists and innovators are disproportionately likely to engage in artistic or creative pursuits, and that artistic practice strengthens habits of observation, abstraction, and divergent thinking essential to scientific discovery [14]. Biochemistry, with its dense multi-layered logic, rewards the same interpretive strategies used in literary analysis: identifying motifs, tracing causality, synthesizing disparate information, and constructing coherent explanatory models. My humanities background therefore became not a liability but a cognitive advantage.

> I had been out of academia for thirteen years when I enrolled as a postbaccalaureate. Everything had changed. I felt a deep fascination with biology and chemistry, especially in the laboratory. My years of working with my hands creatively in the arts and building promotions from abstract concepts into concrete engagements carried me through my experiments. I entertained the idea of being "an experimentalist" before I even knew how to qualify that title. In the laboratory, I was in my element regardless of my experience outside.
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> Enter calculus. I had no idea that enrolling in a class with a meeting time marked "TBD" meant that I would be taking my first math class since 2004 in an online setting. Online learning was nowhere near as prevalent in the early 2000s as it is today, and I was intimidated by my inexperience. The Khan Academy videos over the previous month had helped me foster a general understanding of the concepts I would be learning in calculus, but after the first online lecture when the professor asked if there were any questions, in a moment of bewilderment and self-doubt I asked if I should drop her course and take precalculus. I explained that I got a C in my last meaningful math class two decades prior. She encouraged me to persist but told me

that this was going to be one of the toughest academic challenges I had ever faced if I did not have the time to relearn the basics.

I enrolled in a calculus workshop through the Scholar Enrichment Program, sought tutoring there nearly every day, and formed study groups with other students who were in the classes I'd been taking. I had made the decision long before I returned to academia that there was no "coolness" in going back. The nonchalance that characterized the undergraduate version of myself had to be disregarded entirely. I had to approach each subject with humility so that I could get the most out of my education, but there is nothing quite as humbling as being taught foundational math by a 17-year-old Biomedical Engineering Major. That (once) 17-year-old has been one of my best, most dependable friends for anything academics-related over the past two-and-a-half years. We have built several study groups together since then, joining people with a diverse range of specific academic skills in order to have a comprehensive approach to studying any subject we shared.

Study groups have been the bedrock of my academic success as a returning student. Teambuilding has been a skill of mine for a long time, but I view group learning as an even higher version of communal mutual aid. There is no hierarchy in a study group, no elevation of the individual, there are only equals working toward a common goal. The expectation is that each individual brings their own set of skills to be shared by the group, and that through decentralized teaching, every individual of the group can osmose information through their diverse approaches to understanding the material. I've only recently realized that the familiarity of the peer instruction of the study group correlated directly to my time spent in creative writing workshops and painting critiques—all are rooted in the shared construction of meaning and understanding of

the subject matter. Anecdotally, those that have seen the value in these study groups and regularly contribute have seen greater overall success than the people who have joined and wavered in their input.

**Communication, Soft Skills, and Building Scientific Relationships**

*"Science never cheered up anyone. The truth about the human situation is just too awful."—Kurt Vonnegut*

Humanities training excels at what STEM curricula often overlook: communication. Years of creative writing workshops and painting critiques trained me to articulate complex ideas, give and receive feedback constructively, and communicate across (or in spite of) differences. They taught me the importance of being able to encapsulate and clarify abstraction. These skills became invaluable when forming relationships with faculty, approaching professors during office hours, and participating meaningfully in mentorship conversations.

As a result, several professors—including senior faculty in biochemistry—offered to write letters of recommendation for my medical school applications without my requesting them. I've also been asked to write letters of recommendation in turn for several former professors for academic honors for which they have been nominated. This was not due solely to academic performance, but because communication built trust, rapport, and mutual respect. For example, I *liked* Organic Chemistry initially because I got to draw—I called the class "Hexagons 101." I started to *enjoy* Organic Chemistry because I had an incredibly rigorous professor who challenged the way I thought about science. I began to model my interpretation of the subject as learning a new language while simultaneously learning to solve puzzles in that language—framing a notoriously difficult discipline as a game to be mastered. I started to *love* Organic Chemistry when I realized that my professor had an affinity for sci-fi that rivaled my own. Our mutual love of the genre garnered a sort of mutual respect that kept me engaged and made coming to class a joy. I

always had something to talk about with her during office hours and have maintained communication with her even after her retirement.

Research in medical education consistently demonstrates that communication skills are critical not only for bedside interactions but also for academic success and faculty engagement [13, 16]. The AAMC PREview Exam, referred to in premedical circles as "the empathy test," is designed to evaluate personal accountability and relational skills for aspiring medical professionals [1]. This has led to some unintended consequences. In her chapter in *Empathy: From Bench to Bedside, [16]* Johanna Shapiro argues that beyond the administration of these kinds of exams, the cognitive-behavioral approach to teaching empathy to preclinical students runs the risk of becoming a solely intellectual exercise and that empathy can become understood as a transactional approach to achieving selfish ends. This is highlighted in a section aptly titled "Fake Empathy." She asserts that since physicians increasingly self-identify as belonging to a logicoscientific tradition, they are likewise progressively alienated from their patients rather than empathetic toward them. Still, the AAMC explicitly emphasizes the necessity of accessing empathy for the overall efficacy of a physician for the treatment of patients [1]. The competitive atmosphere between undergraduate premeds extends to and is exacerbated by medical school assessments where limited preferred residency matches are never far removed from the minds of the students. Ironically, life experience beyond the compulsory academic/exam standards (GPA and favorable MCAT scores) emphasizing soft skills like empathy, adaptability and creativity are often cited as attributes that make outstanding prospective medical students. In studies like *The Art of Empathy*, [7] an art-based curriculum was developed for fostering empathy through meticulous and collaborative observation among interns at Brigham and Women's Hospital. Positive results were reported among the interns for promoting a deepening of empathetic capacities.

My decade-long marketing career amplified these interpersonal competencies that were instilled by my undergraduate liberal arts experience. Exposure to diverse communities allowed me to find common ground with nearly anyone—students, professors, clinicians, and patients. This capacity for connection became essential during my volunteer work with a mariachi group* performing for individuals with dementia, which led directly to clinical shadowing opportunities. It also shaped my approach to building study groups for nearly every course I've taken, where I found that group learning and peer-teaching fostered collective mastery, aligning with established research showing that peer instruction enhances STEM learning [4].

*As a Texan, mariachi holds a special place in our culture, present at every major life transition from weddings to funerals. I had a lot love for the artform and I had even once hired a mariachi band for a satirical protest that gained worldwide attention.[3] In the summer of 2024, I took an intensive physics course where I formed a study group with a young aspiring veterinarian who happened to play in a non-profit mariachi band serving memory care facilities. We bonded over the coursework, and our study group's dedication eventually led our professor to invite us to join his nanophysics research group.

The connection didn't stop at the lab bench. The following semester, while waiting on experiment results, we traded a guitar back and forth. He invited me to join his band for a collaboration with the University of Houston's BRAIN center. We traveled to a neuroscience convention in Baltimore, where I wore an EEG cap while playing onstage to gather data on neural pathways. I recognized the opportunity to participate not just as a musician, but as a scientific contributor. It was the epitome of STEAM: the synthesis of art, music, and therapy actively advancing neuroscience research.

**Humanities Skills and Institutional Navigation**

*"There is today-in a time when old beliefs are withering-a kind of philosophical hunger, a need to know who we are and how we got here. It is an on-going search, often unconscious, for a cosmic perspective for humanity"—Carl Sagan*

One of the least discussed aspects of pursuing a STEM degree, especially as a nontraditional student, is navigating the complex administrative structures of the university. Scholarship applications, program requirements, financial aid, research opportunities, and letters of recommendation all require strong writing skills, persuasive communication, and familiarity with bureaucratic systems. The continuation into graduate school and beyond further underscores these skills in the forms of grant writing and scientific communication of experimental results. Mentorship for undergraduates can come from the most unexpected of sources, and success for said undergraduates can hinge on the ability to not only recognize but utilize the communication skills necessary to pursue the prospect.

My humanities training made these tasks more manageable. Writing personal statements, grant-style scholarship and fellowship essays, and professional emails felt natural because these fields rely on storytelling, clarity, and audience awareness skills honed through analytical and creative writing. These proficiencies in professional writing have resulted in my being the recipient of several university scholarships and awards including a Summer Undergraduate Research Fellowship for a proposal titled "Quantum Transport in Nanotube-Suspended Complex Sol-Gels"—both 1) a mouthful and 2) a celebrated personal accomplishment for the ability to excite a selection committee about *that level* of material science. Many STEM peers struggled with these tasks, despite excelling in coursework, because they received less explicit training in written and oral communication. Research shows that communication and critical thinking skills predict success in health sciences and professional advancement,[6] reinforcing the necessity of integrating humanities competencies into scientific training.

The assumed superiority of STEM to liberal arts among the students has been justified to me in terms of the rigor required to pursue a degree in the sciences and, admittedly, is not without some merit. What I was completely unprepared for upon entering scientific study was intra-STEM prejudices between "soft," qualitative scientific disciplines and the "hard," quantitative divisions—the educational equivalent of choosing a side in the Star Wars v. Star Trek fandom debate while ignoring the underlying truth that neither franchise would exist without the synthesis of art and science into science fiction. Disturbingly, between 2011 and 2017 the number of degrees awarded annually in the US dropped by more than 10% in nearly every subject in the humanities while the number of STEM degrees rose in all subjects [12]. As focus shifts towards STEM and away from humanities in student demand, criticism has risen among even science leaders in academia that students are underprepared for the "messiness" of the real world. There is consensus among members of the National Academies that there is a groundswell of support for integration between the disciplines to better serve and help foster the education of more well-rounded students. Likewise, the bureaucratic fluency humanities graduates carry is an elemental advantage in STEM fields where scientific ability intersects with administrative gatekeeping.

> At the end of my second semester, drowning under the weight of studying for multiple finals, I had an out-of-body experience when walking across campus to my car. An English class was sitting on the lawn discussing a novel. I remembered back to the last day of my very last literature class as an undergrad: our professor had us sit on the lawn and discuss what we had learned in class that semester—not for a grade, purely for discussion and debate. I didn't know if it was resentment or jealousy that caused me to roll my eyes, but I finally understood what the other STEM undergrads were telling me about Liberal Arts majors having it easier than we did.

While my undergrad experience was anything but typical, I could understand how to an outside perspective it seemed less than rigorous. Semester-long writing projects and portfolio critiques don't carry the same universal dread that the standardized comprehensive exams or infamously pedantic lab finals do. It's difficult to explain to the undergraduate STEM contingent the vulnerability felt in sharing original art with a classroom of peers and mentors only for it to get ripped apart in critique; or how writer's block could ruin your whole semester. It would be equally difficult to explain to a history major how a 60 on a physics exam could be the highest grade in the class and therefore curved up to an A. The respective rubrics for grading are foreign, and the thought processes are completely dissimilar.

If "hard" science is the realm of quantitation and objectivity, the curriculum must necessarily be assessed as such. Humanities curricula are…not that. Each discipline varies wildly in its subjectivity, and while my experience was primarily in the creative sector, my liberal arts degree plans required fundamental understandings of history, philosophy, literature and sociology to inform the creative process. Originality in STEM is most often rewarded at the highest levels of theory and experimentation due to new discovery, but discouraged in undergraduate experimental education where adherence to standard practice is meant to build coherent laboratory skills. Originality in the creative arts is rewarded qualitatively and subjectively at all skill levels by focusing as much on content as proficiency in communicative ability. Counterintuitively, what often drives interest in STEM is the ability to relate to the history of the scientific community. We build lore around our heroes in STEM just like we mythologize the eccentricities of literary giants or visual artists. Larger-than-life personalities of certain scientists rise to the same level of fame as their intellectual

contributions. Excellence in science communication, especially when writing for the layman, elevate the communicator in public esteem. Stories of scientific feuds like that of Edison and Tesla, Newton and Leibniz, Watson/Crick/Wilkins and Franklin make for excellent conversation material even outside of science. Unreliable narrators abound! Antiheroes everywhere! What drama!

The ability to take these subjects and weave narratives around them is a sneaky tactic that the best teachers in STEM already use to humanize and make scientific advancement more relatable—to tie the subject matter into the real world.

Looking back on the English class on the lawn and remembering my own experience doing the same, I realized it was one of my favorite moments of my time as an undergrad. The initial repulsion/jealousy/self-pity I had in that moment slips away. It was a moment I was fortunate to have, one that I wish every student—regardless of concentration—would be able to share in, much like I wish I could share with humanities students the moment when I knew I fell in love with calculus.

**Building Community: Peer Learning, Leadership, and Interdisciplinary Networks**

*"If you want to master something, teach it. The more you teach, the better you learn. Teaching is a powerful tool to learning."—Richard Feynman.*

Beyond coursework, my identity as a scientist has been shaped by the communities I participate in—many outside traditional scientific spaces. I'm employed by my university as a personal trainer, CPR/First Aid instructor and compliance drill team member. I'm active in several student organizations and an officer in two. I am the chief scientist and laboratory manager for my undergraduate nanophysics research group. Playing baseball on a sandlot team introduced me to researchers, engineers, and medical professionals who have become mentors and

collaborators. My mariachi volunteer work bridged music, culture, research and medicine, connecting me with clinicians dedicated to dementia care. These interdisciplinary associations emerged organically because humanities-trained networking skills enabled me to engage with diverse groups.

Within STEM courses, I often initiated study groups because collaborative learning resonates with my creative and pedagogical instincts. Teaching others, explaining mechanisms aloud, and synthesizing course content strengthened not only my own understanding but also class participation and performance [4, 5]. This aligns with Vygotsky's theory of social learning [11] and modern evidence that peer-supported learning improves conceptual retention and problem-solving ability in science. Vygotsky's Zone of Proximal Development (ZPD) is an intellectual "Goldilocks gap" between what a learner can do alone and what they can do with the support of a More Knowledgeable Other (MKO) who provides scaffolding to build on the knowledge of the learner. By creating diverse study groups with people of differing specialties and skill sets, we decentralized the "MKO" to be anyone in the group who could provide new insight to the others. When every member of the study group is effectively both a learner and a teacher, there are redundancies of overlapping knowledge that have led to the success of everyone participating. Several professors have taken to recommending our study groups to other students that have fallen behind in their classes to varying levels of success dependent on their commitment. I can only speak anecdotally on this subject, but for my learning style there has been no greater determiner of grade point success in a class than the strength of that class's specific study group.

It was the Arrhenius equation.

I later made the joke to my professor that I don't know if it was Stockholm Syndrome or some other anomaly, but as a person who never gravitated toward mathematics, I

found myself falling in love with calculus when I began to understand that every other physical science I was studying required the same decay function. I never understood that in order to "do science," you needed to learn the language of change, and that meant that we needed to be able quantify that change using calculus. There was a specific beauty in being able to predictively model real-world chaos with a deceptively simple equation. I'd spent most of my time in calculus memorizing equations for the exams. This was different. I was having fun.

Almost immediately after learning the decay function, it showed up again in biology in the form of radiocarbon dating. That same week, when we were learning reaction kinetics in general chemistry, on a slide labeled "the Arrhenius equation," the decay function appeared again.

The familiar epiphanic rush from my yoga class a year before had returned. Here I had been learning integration techniques in one class without knowing that I would be integrating a single technique for modeling predictable decreases into every other subject I would study for the rest of my time as a postbacc. There was philosophical beauty in the universality of this equation. Math was finally cool and I felt like I had been let in on something esoteric. This felt like the first time I'd ever published a poem or sold a painting. This new language I was learning granted me access to communicate with a secret society of people hidden in plain sight—those that passionately cared about quantifiably modeling truth. I started thinking of myself as a scientist.

I began proselytizing the gospel of calculus to my very uninterested friends and family—reminded again that my own interests do not supersede the interests of others. I could hear my former self in their replies, "I hate math." "My brain just doesn't work

like that." "I don't know how you do it." However, there was one person who showed interest.

One friend, however, showed interest. Jesse, a former bar industry colleague who had witnessed my health transformation, decided to return to school a year after I did. Late one night, he messaged me, frustrated that he could solve algebra problems but didn't understand their purpose or relation to a graph.

I told him I didn't even understand the purpose of it until I took calculus. Over the next two hours, I explained that a Cartesian plane is just a way to model how a dependent variable relates to an independent variable, and that the slope of the line was the rate of change between them; that nonlinear models on a Cartesian plane have differing rates of change; that an instantaneous rate of change was called a derivative, etc. I got to nerd out about calculus with a friend of mine which was an entirely new experience for me. I got to draw models to provide visual aids. I explained to Jesse that y=mx+b is just a sentence in another language—a sentence that tells a story of the change in a relationship. I dove into the history and told him the reason why we call it a Cartesian plane is because Descartes is credited with its invention. "You mean the 'I think therefore I am' guy!?" he asked. "The same." I replied. I told him about Newton developing calculus to explain physical phenomena like motion and gravity. I explained how the decay function could also be interpreted as a sentence and how that "simple" equation was what made me fall in love with not just calculus, but the interconnectedness of STEM overall. His response to this conversation made me feel like I was good at teaching: "Dude, until this moment, I didn't understand how y=mx+b applied to anything and I don't think I understood what it meant."

> This breakdown of a concept using a multi-disciplinary approach, peer teaching, language, art, history, and even (indirectly) philosophy to help a friend understand math crystallized my belief that the humanities serve a crucial role in developing interdisciplinary understanding of the physical world. With humanities and STEM education, one is not more important than the other—both are necessary for a cohesive appreciation of mankind's place in the universe, our ability to relate to each other, and our ability to relate to ourselves. It was the moment that inspired this paper.

**Conclusion**

> *"If I have seen further it is by standing on the shoulders of giants."—popularly attributed to Isaac Newton.*

My journey from the liberal arts to biochemistry and premedical training illustrates the deep, often overlooked cooperation between the humanities and the sciences. The cognitive flexibility, communication skills, spatial reasoning, and interpersonal competence developed through my liberal arts education have directly strengthened my scientific performance and professional relationships. Far from being an outlier, my experience reflects a growing recognition in scientific and medical education that interdisciplinary backgrounds produce more empathetic, creative, and resilient scientists.

As medical schools continue expanding holistic review processes and as STEM continues evolving toward collaborative, communication-heavy research models, the humanities should not be treated as peripheral electives but as foundational intellectual tools. Integrating the humanities into STEM education—and valuing students who bring interdisciplinary strengths—will not only enrich scientific training but also cultivate scientists and clinicians capable of navigating the human dimensions of medicine and research. An epistemological approach to integrating core philosophies of humanities education with that of the STEM field

as opposed to viewing them as distinct entities builds to a contemporary focus on a "STEAM" (Science, Technology, Engineering, Arts, and Mathematics) model that fosters greater interplay between concrete and abstract thought, leading to interdisciplinary comprehensive fusion of methods of understanding while allowing for adaptation and invention. My story is only one example; the broader lesson is clear: the future of science is not narrower specialization, but deeper cross-disciplinary fluency. Relevant work/life experiences stemming from this bilateral education cannot be discounted in their influence over future academic and career endeavors. As a future physician, I expect to be both a scientist and narrator of patient experience—I could not have asked for a better preparation to uphold the responsibility of both than the full-spectrum education I have received through my liberal arts and natural science degrees (as well as the understanding gained through lived experience of navigating the world outside of academia). It is my ultimate hope that other STEM students get to have their own interdisciplinary "moment on the lawn". I hope they view the world in all its messy complexity, its shades of grey, its inundation of information. May they interpret, analogize, and appreciate the phenomenon of education not solely as the means to an end of employment, but to value learning itself as an ongoing process and an ever-present foundation for self-improvement. Integrating humanities competencies into STEM education is not optional—it is an educational imperative if we seek scientists and physicians who can reason, communicate, empathize and innovate.

**Acknowledgements**

I'd like to extend my gratitude to everyone mentioned in this paper, especially my professors, tutors, friends, and study groups with special thanks to Dr. Seamus Curran, CNRG, The Biochemistry Department at the University of Houston, and Paul Brewer for his editing skills.

**References**

[1] AAMC. (**2024**). *About the AAMC PREview® Exam*. Students & Residents. https://students-residents.aamc.org/aamc-preview/about-aamc-preview-exam

[2] AAMC. (**2025**). *Holistic Review in Medical School Admissions*. Students & Residents. https://students-residents.aamc.org/choosing-medical-career/holistic-review-medical-school-admissions

[3] Castrodale, J. (**2021**, February 25). *Texans Sure Love Brutally Roasting Ted Cruz*. VICE. https://www.vice.com/en/article/texans-sure-love-brutally-roasting-ted-cruz/

[4] Crouch, C. H., & Mazur, E. (**2001**). Peer Instruction: Ten years of experience and results. *American Journal of Physics*, *69*(9), 970–977. https://doi.org/10.1119/1.1374249

[5] Fagen, A. P., Crouch, C. H., & Mazur, E. (**2002**). Peer Instruction: Results from a Range of Classrooms. *The Physics Teacher*, *40*(4), 206–209. https://doi.org/10.1119/1.1474140

[6] Harasym, P. H. (**2008**). Neuroplasticity and Critical Thinking. *The Kaohsiung Journal of Medical Sciences*, *24*(7), 339–340. https://doi.org/10.1016/s1607-551x(08)70130-x

[7] Harz, D., Simpkin, A. L., Reem Alansari, Esparza, R., Zimmermann, C., Evans, B., Eisenberg, S., & Katz, J. T. (**2023**). The art of empathy: Teaching empathy through art. *The Clinical Teacher*. https://doi.org/10.1111/tct.13643

[8] IMDb. (**2016**). *Bryan Hlavinka*. IMDb. https://www.imdb.com/name/nm8463932/?ref_=nmmi_ov_bk

[9] Lage-Gómez, C., & Ros, G. (**2024**). On the interrelationships between diverse creativities in Primary Education STEAM projects. *Thinking Skills and Creativity*, *51*, 101456. https://doi.org/10.1016/j.tsc.2023.101456

[10] Libosada, I., Andry, A., Sagcal, R. R., Acut, D. P., Roleda, L. S., & Prudente, M. S. (**2025**). Fostering scientific creativity in science education through scientific problem-solving approaches and STEM contexts: a meta-analysis. *Disciplinary and Interdisciplinary Science Education Research*, *7*(1). https://doi.org/10.1186/s43031-025-00137-9

[11] McLeod, S. (**2025**). *Vygotsky's sociocultural theory of cognitive development*. Simply Psychology. https://www.simplypsychology.org/vygotsky.html

[12] Mullin, R. (**2019**). *Behind the scenes at the STEM-humanities culture war*. Chemical & Engineering News; American Chemical Society. https://cen.acs.org/education/undergraduate-education/Behind-the-scenes-STEM-humanities-culture-war/97/i29

[13] Rider, E. A., & Keefer, C. H. (**2006**). Communication skills competencies: definitions and a teaching toolbox. *Medical Education*, *40*(7), 624–629. https://doi.org/10.1111/j.1365-2929.2006.02500.x

[14] Robert Scott Root-Bernstein, & Michèle Root-Bernstein. (2001). *Sparks of genius : the thirteen thinking tools of the world's most creative people*. Houghton Mifflin Co.

[15] Root-Bernstein, R., Allen, L., Beach, L., Bhadula, R., Fast, J., Hosey, C., Kremkow, B., Lapp, J., Lonc, K., Pawelec, K., Podufaly, A., Russ, C., Tennant, L., Vrtis, E., & Weinlander, S. (**2008**). Arts Foster Scientific Success: Avocations of Nobel, National Academy, Royal Society, and Sigma Xi Members. *Journal of Psychology of Science and Technology*, *1*(2), 51–63. https://doi.org/10.1891/1939-7054.1.2.51

[16] Shapiro, J. (**2011**). The Paradox of Teaching Empathy in Medical Education. *Empathy*, 274–290. https://doi.org/10.7551/mitpress/9780262016612.003.0016

[17] Sternberg, R. J., Todhunter, R. J. E., Litvak, A., & Sternberg, K. (**2020**). The Relation of Scientific Creativity and Evaluation of Scientific Impact to Scientific Reasoning and General Intelligence. *Journal of Intelligence*, *8*(2), 17. https://doi.org/10.3390/jintelligence8020017