International Journal of STEM Education

EDITORIAL Open Access

In memory of Jeffrey E. Froyd: a collection of tributes

Yeping Li[1*], Jorja L. Kimball[1], Ronald Ulseth[2], Rebecca A. Bates[3], Maura Borrego[4], Sandra B. Nite[1], Julie P. Martin[5], Charles R. Henderson[6], Renée S. Cole[7], Suzanne M. Ruder[8], Juliette Lantz[9], Rachel L. Kajfez[5], Emily Dringenberg[5], David A. Delaine[5] and Cara Froyd[10]

Keywords: Engineering education, Jeffrey Froyd, Memory, Tributes, STEM education

Dr. Jeffrey E. Froyd was the first and only associate editor (AE) of the *International Journal of STEM Education* (IJSTEM) from the beginning. He passed away on October 5, 2022 at the age of 68, ending his 8-year tenure with the journal. Over his professional career as an educator, researcher, and editor, Jeff positively impacted many individuals' work and career development, and contributed to the professional society as a whole. This editorial serves as an opportunity to put together a collection of reflections, in which we share individual experiences of interacting, collaborating, and working with him.

In memory of Jeff Froyd over his professional career, this collection of tributes goes beyond his association with IJSTEM. Jeff earned a Bachelor of Science in Mathematics from Rose-Hulman Institute of Technology and a Master of Science and Ph.D. in Electrical Engineering from the University of Minnesota, Minneapolis. He worked as a professor of engineering and engineering education at multiple higher education institutions, including Rose-Hulman Institute of Technology, Texas A&M University, and The Ohio State University. He was elected as Fellow of two professional societies, the Institute for Electrical and Electronics Engineers (IEEE) and the American Society for Engineering Education (ASEE), and served as an ABET (Accreditation Board for Engineering and Technology) Program Evaluator for the Engineering Accreditation Commission. He also served in various leadership and administrative positions, such as the chair of the Department of Engineering Education, College of Engineering, The Ohio State University since 2020. Moreover, Jeff served as the editor-in-chief for the *IEEE Transactions on Education*, an associate editor and then senior associate editor for the *Journal of Engineering Education*. As contributors to this collection had various personal and/or professional connections with Jeff throughout his career, contributions in this nature can collectively help present a vivid picture of Jeff Froyd in our memory as an educator, mentor, researcher, colleague, leader, and friend.

With the unique value of each contribution, it is almost impossible to find a perfect way of organizing these contributions to this collection. As the initiator of this collection, I made an editorial decision to organize the contributions. Instead of specifying and classifying the nature of each contribution, I ordered the contributions along the timeline that shows approximately when each contributor started to interact, meet or work with Jeff. The ordering may help demonstrate Jeff's contribution and impact to many others along his professional career. The collection is further made special with the contribution from Cara Froyd, his daughter with a Ph.D. in biochemistry. Thus, I have book-ended the collection with Cara's contribution that helps highlight Jeff's contribution and impact as a scholar and mentor also in his personal life.

The following is my own reflection.

Jeff Froyd was a research professor at Texas A&M's Engineering Experiment Station and Engineering Academic and Student Affairs office when I started to put

*Correspondence: yepingli@tamu.edu

[1] Texas A&M University, College Station, TX 77843-4232, USA
Full list of author information is available at the end of the article

together the editorial board for IJSTEM in 2013. At that time, he was also serving as editor-in-chief for the *IEEE Transactions on Education* and as a senior associate editor for the *Journal of Engineering Education*. With his extensive experience in journal editing and publishing, I approached and invited him to work together on IJSTEM. He agreed to serve in the role of AE, and also helped suggest some other engineering educators as candidates to serve on the editorial board.

Having a journal in STEM education was something relatively new at that time. There were a lot of uncertainties about what this journal might do for the research community, especially since the journal has not been associated with any professional societies. Jeff shared with me about Boyer's model of scholarship (Boyer, 1990) and challenged me to think about the scholarly nature of this journal and how to position the journal in terms of its scholarship contributions to the community. I conceptualized the journal's position in relation to other existing journals in the inaugural editorial (Li, 2014), but I was not able to consider and discuss the nature of scholarship that this journal's publications may contribute to at that time. Jeff's challenge still remains in my mind.

We often had lunch meetings at Chipotle next to campus to share and discuss different aspects of the journal, before he eventually left for The Ohio State University in 2017. As I did not develop and use specific agendas for those lunch gatherings, we chatted about different topics that evolved over time, including manuscript format and management, possible 'hot' topics in the field, ways of promoting the journal, and issues specific to a manuscript. Jeff was responsible for suggesting that we have a structured abstract format for research articles published in this journal. Those lunch meetings were great moments for my learning that will be kept in my memory forever.

Jeff's contribution to this journal and our collective achievement is tremendous and can be clearly felt, as there were still some manuscripts kept under his management to the last day. We remain forever grateful for the impact his contribution and leadership had on this journal.

Yeping Li,
Texas A&M University, College Station,
Editor-in-Chief, *International Journal of STEM Education.*

Reflections from Jorja L. Kimball

My first interaction with Dr. Jeff Froyd was in the early 1990s on the NSF Foundation Coalition (FC) grant. In addition to participating in a dedicated and group one had fun with, it was a marvellous introduction to the commitment and enthusiasm for learning that Jeff had! His strength of commitment was deep, especially when being brave enough to try out new meeting and teaching methods to a group of Engineering Deans and Faculty!! Jeff, along with others, knew they were herding cats, and went at it anyway!

He won my forever thanks for lending his intellect and working with me for what would turn out to be over 30 years of our careers. And in my case Jeff mentored me from the beginning as a non-Ph.D., Mexican American woman, who also just wanted the best for engineering students in South Texas. I am not alone in admiring Jeff's commitment to education and that improvements could be made to curriculum and teaching methods to benefit ALL students, and especially those under-represented in STEM! The fact that Jeff would take time to explain and work with me as a staff member and on efforts that benefited DEI, before that was even a term, was perhaps not as striking to me then, as it is today when I reflect back.

Many of us also had the pleasure of getting to know Jeff further during his time at Texas A&M University. I worked with him on various proposals, and he encouraged and helped me with aspects of my dissertation, and my appreciation for that is unending. We made each other laugh, mostly because we were so opposite each other. I admired his desire for new and interesting projects with researchers he enjoyed working with, and with scholarly structure as part of all his work through the years I knew him.

Jeff shall be missed by me and so many others. I am amazed at how many faculty he knew and how much he served, at times more in the capacities that do not get much limelight or praise and require lots of work. I will be forever grateful to have met, worked with, and known Dr. Jeff Froyd, and will always think of him with the view of all he did for the research and practice of engineering education. Farewell, mi amigo! Hasta la vista!

Jorja L. Kimball, Ph.D.
Regent's Fellow,
Executive Director, Research Development,
Texas A&M University, College Station.

Reflections from Ronald Ulseth and Rebecca A. Bates

Jeff Froyd was an architect of the Iron Range Engineering program. Starting on an early development team in 2002, Jeff was all-in on the idea of creating a new way of learning engineering through actually doing engineering. His early guidance set in motion the start of the project-based learning model implemented at Minnesota State University, Mankato. The program began in 2010 and was successfully accredited in 2013, in large part because of Jeff's influence. Jeff transitioned from developer to leader of our national advisory board, where he gave thoughtful and sometimes stern guidance at every meeting up

through April of this year. Faculty remember his quiet pauses, with hands held together below his chin, before he made a suggestion that would open up new possibilities and directions for extending innovation. Through his questions and suggestions, we changed the name of our major from general engineering to integrated engineering, a name that is starting to have international impact through its use at multiple universities. We can point to our many graduates, most of whom started in community colleges, and see the long-term impact Jeff has made on students and engineers all over the country. While our program may be small, it's a great example of the strength of Jeff's influence in all corners of engineering education. As each of our other initial advisory board members retired from the board, we named an engineering project room in their honor. We will soon do the same for Jeff, although with a feeling of incompleteness that he will not be there to accept the honor.

Ronald Ulseth, Iron Range Engineering, Minnesota.

Rebecca A. Bates, Minnesota State University, Mankato.

Reflections from Maura Borrego

I remember being so excited, way back in 2006 as a young assistant professor, to meet Jeff Froyd, running to catch up to him as we walked from the hotel to the meeting venue to discuss change in engineering education with a group of sociologists. From the beginning, he was kind, approachable, and insightful with a sense of "dad humor" that reminded me of my own father.

Jeff had the best ideas that were often ahead of their time. I was there to witness some of them, and I have my suspicions about his key role in other, earlier movements in STEM education. It was Jeff's idea to bring systematic review methods to engineering education, and he had been calling for attention to faculty change processes since the 1990s. He helped me deal with the sting of rejection resulting from being young and unknown in a new field. He taught me persistence when others weren't quite ready to fund or publish our ideas. I remember him telling me once when I was ready to give up on resubmitting an NSF proposal that a Nobel Laureate thought our related conference poster was "interesting," and therefore, we should resubmit the funding proposal. Jeff was right, of course, and the rest is history. As I developed confidence and established my career under his tutelage, I had the opportunity to sit back and observe him as a mentor in action. Jeff used humor to defuse tense situations, rarely if ever claimed credit for his ideas, and always put his junior colleagues' careers first.

In the process of remembering and sharing, I realize I'm not alone in the impacts Jeff has had on my life. Therefore, many others could have written similar tributes with different details and time scales. Jeff Froyd has a tremendous legacy in shaping the course of our field at both the personal level of individual researchers and more broadly in our thinking and tools of research and education.

Maura Borrego,

University of Texas, Austin.

Reflections from Sandra B. Nite

Jeffrey Froyd was a valued member of my dissertation committee. I first met him in 2007 at Texas A&M University College Station, Texas, as we were working on a team to develop and then implement a National Science Foundation (NSF) grant in the Improving Undergraduate STEM Education program. I was on the mathematics faculty and a Co-PI on the project; Jeff was our internal evaluator.

The Texas Engineering Experiment Station (TEES) had an NSF grant for which they held semi-annual conferences to discuss STEM talent expansion. At these events, Jeff was always one of the speakers. He challenged my thinking with his insightful comments on mathematics and engineering. We also had some individual conversations about such topics as key foundational mathematics concepts that are critical to success in calculus for engineers. As far as I know, Jeff never clearly identified those most basic concepts and the essential underlying knowledge, and neither did I. I suspect it is impossible to dissect the mathematical concepts enough to get there. However, it gave me much to consider in teaching mathematics and drilling down on key concepts in mathematics for non-STEM majors as well.

I was impressed with Jeff's philosophy about his responsibility as a member of my dissertation committee. He was diligent in reading the manuscripts I sent to the committee. More than that, I appreciate that he gave me an assignment for a contribution to an article he and others were writing for the IEEE Frontiers in Education conference. This opportunity allowed me to earn a publication and to collaborate with a group preparing a manuscript for the conference proceedings. Jeff was always ready to talk about important issues in engineering education, and those conversations always led to deeper thinking and consideration of important ideas for improving engineering education. I appreciate so much Jeff's impact on my thinking about mathematics and engineering education.

Sandra B. Nite,

Research Scientist, Texas A&M University, College Station.

Reflections from Julie P. Martin

Jeff Froyd was a giver, and he was a gift to those of us in the field of engineering education. Jeff was involved in so many things, but he was never too busy to share his time, his wisdom, his skill, or his humor.

My first interaction with Jeff was in 2007, in his role on the editorial board of *Journal of Engineering Education*. I emailed him about the suitability of an article I'd written (my first in the field). He responded with an offer to provide feedback before I submitted. That's the kind of person he was. He freely shared his wisdom to help a novice in the field get her first publication. I took his advice and received what I think is the only "minor revisions" decision I've ever had on the first try for any manuscript! From then on, he became a mentor, a collaborator, a department colleague, and a dear friend.

When we collaborated on a funded project, our team met weekly for more than 3 years (and occasionally after that). Through this, I got an insider's view of how Jeff worked. He was meticulous, but also flexible when things didn't go as planned. He was unfazed when we realized we needed to pivot direction. He had a healthy dose of skepticism that improved the quality of our work, because it made us think through possible critiques and address them early. He included all voices, directly asking graduate students for their opinions when they didn't volunteer them. He publicly credited other people for their ideas.

A few years later, Jeff recruited me to Ohio State. I had just finished a rotation at the National Science Foundation and was equally anxious and excited about starting a new phase of my career. He offered to pick me up on my first day of work so as not to add to my already high cognitive load by navigating parking on a huge new campus. Later, he became my department chair. Recognizing my desire to test the waters of academic administration, he appointed me in an inaugural associate department chair position focusing on our graduate program and research enterprise. This role convinced me to pursue a university-level administration job, which I am now enjoying. Without a doubt, Jeff has influenced nearly every step of my career path and my contributions to the field. This is his lasting gift to me.

Julie P. Martin,
The Ohio State University, Columbus.

Reflections from Charles R. Henderson

Jeff Froyd was an important collaborator of mine. He was one of the earliest researchers to think about change strategies and systemic change. I found these ideas interesting and, early in my career, I invited him to serve on the advisory board for one of my grant projects. Fortunately, he accepted. We later became collaborators and eventually published 12 journal articles and one book together.

My strongest memories of Jeff come from 2014 when we participated, along with a third colleague, in the inaugural I-Corps for Learning initiative run by the National Science Foundation. This was an intensive 8-week program designed to help participants sustain and scale their educational innovations. The program began and ended with 3-day meetings in Washington, DC, where each team presented their ideas multiple times and got feedback. The intensity of this program served to bring teams together quickly and helped us hone our ideas that eventually turned into a book about how to develop educational innovations for sustained adoption. Jeff was a calm and clear presence in this very intense high pressure environment.

Jeff was a strong and creative thinker. One of the important ideas that came out of our work together is that funding agencies and educational developers were not thinking about how to spread their work in the best possible ways. The most common way that they thought about how to spread educational innovations was via dissemination. Working in the dissemination paradigm emphasizes the actions of the developers to develop good ideas and spread the word about them. There is strong evidence that this is not sufficient to create sustained adoption. Thus, we proposed the propagation paradigm as an alternative. Under the propagation paradigm, the focus is on interactions between the developer and potential adopters to understand what adopters need to successfully use the new ideas. We were happy to see that several NSF programs started to use the term propagation in their proposal solicitations.

While he is no longer with us physically, Jeff continues to influence my thinking and my work. I know that I am not alone in benefiting from collaborations with Jeff.

Charles R. Henderson,
Director, Mallinson Institute for Science Education, and Professor of Physics, Western Michigan University,
Editor, *Physical Review Physics Education Research.*

Reflections from Renée S. Cole, Suzanne M. Ruder, and Juliette Lantz

Jeff's influence in improving undergraduate education will have a lasting impact. Asking Jeff to be a member of the Advisory Board in 2015 proved to be a pivotal decision for our project. Jeff usually offered comments sparsely but constructively, and usually in a somewhat abrupt manner. As a result, his comments always caught our attention. This proved to be so very important when, at an advisory board meeting 3 years into our project, he announced that our products weren't entirely aligned

with the very heart of our stated goals—to go well beyond simply evaluating students (as is the usual practice) to providing them with real and actionable feedback. His contributions caused us to rethink our approach and classroom materials, taking us into a new realm of recognizing and further supporting student growth. This led to the development of a unique style of rubric that has been much more impactful than our initial approach would have been. This type of insight and advice characterized Jeff—he was thorough in his analysis of the situation and generous with his insights. This made him a great evaluator, advisor, and mentor—especially to this group of chemists.

Renée S. Cole, University of Iowa,
Suzanne M. Ruder, Virginia Commonwealth University,
Juliette Lantz, Drew University.

Reflections from Rachel L. Kajfez, Emily Dringenberg, and David A. Delaine

Jeff Froyd stands out as an amazing and influential leader in engineering education, especially in his role as a formative mentor to many. When he joined us in the Department of Engineering Education at The Ohio State University in 2017, he was tasked with mentoring not one, not two, but all three of us as we navigated our time as assistant professors in a brand-new department. Jeff spent countless hours working directly with each of us. He got to know us as people and scholars, and his commitment to our success manifested as he worked closely and patiently with us to clarify our thinking and craft arguments solid enough to convince others to fund our proposals and publish our papers! Jeff also pushed us to understand what an impact we could have to change the field of engineering education through research and in practice. Despite his standing as a well-established and respected leader in the field, he was always willing to roll up his sleeves and dive deep into supporting our work by reviewing and helping us revise our written work step-by-step over many iterations. Our time with Jeff substantially elevated the way we each perform as scholars. We knew we could lean on Jeff; he was always generous with his time, feedback, and wise insights. He never said no, even when his time was limited and as he mentored many others. He was our advocate and friend. He wanted to see us all succeed and never asked for anything in return. His mentorship had a great impact on each of us, and we are deeply grateful to have known and worked so closely with Jeff during the final phase of his career. He will truly be missed, and we are proud that his legacy will live on through us as we teach others because of what he taught us.

Rachel L. Kajfez, Emily Dringenberg, and David A. Delaine,
The Ohio State University, Columbus.

Reflections from Cara Froyd

"Be a learner, not a performer."

I lost count of how many times my dad said those words to me growing up as he encouraged me to worry less about the grades I got and more about learning and understanding the subject matter. Like many things my dad said and did, that saying annoyed me to no end when I was in high school and college. And, like many things my dad said and did, he was right.

However, my dad didn't simply instruct me to be a learner, not a performer. He demonstrated it through his own example of constantly reading and learning and being curious about the world around him. He practiced what he preached and taught me by asking questions rather than telling me what to do. Admittedly, this was often frustrating as his daughter, particularly when I'd ask for help with homework. I remember the aggravation and occasional frustrated tears that would come when he wouldn't simply tell me *what to do* to solve a problem but would ask questions that were meant to lead me to understanding the material more deeply. My high school self just wanted to get my homework *done*. I wanted to perform, not learn.

My adult self, however, has grown to appreciate my dad's approach both in education and in life. His example of asking deep questions and his own constant learning set my own foundation of questioning how and why that led me to graduate school to study questions about the molecular basis of how and why. The humility he demonstrated in not seeking accolades or recognition reinforced that the process of learning and the challenge to use that knowledge were rewards unto themselves. My father also taught me that the process was never finished. There was always something more or new to learn and incorporate into my understanding.

That approach he taught me has served me in life as well. Life outside of academia and research isn't any more straightforward than the questions I asked in graduate school, and there is no one providing simple answers about *what to do* in life; my dad would never give me one if I asked. Instead, he would ask questions to understand the matter at hand, teaching me to do the same. I'll miss my dad and his questions, but I'll carry his example with me and do my best to follow it.

Cara Froyd,
Purohit Navigation, Chicago.

Acknowledgements
The authors would like to thank Marius Jung and the staff at SpringerOpen for their support in publishing this editorial.

Authors' contributions
All authors contributed to this editorial. YL organized, compiled, and submitted this collection. All authors read and approved the final manuscript.

Declarations

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Texas A&M University, College Station, TX 77843-4232, USA. [2]Iron Range Engineering, Virginia, MN, USA. [3]Minnesota State University, Mankato, USA. [4]University of Texas, Austin, USA. [5]The Ohio State University, Columbus, USA. [6]Western Michigan University, Kalamazoo, USA. [7]University of Iowa, Iowa City, USA. [8]Virginia Commonwealth University, Richmond, USA. [9]Drew University, Madison, USA. [10]Purohit Navigation, Chicago, USA.

Received: 7 November 2022 Accepted: 8 November 2022
Published online: 29 November 2022

References

Boyer, E. L. (1990). *Scholarship reconsidered: Priorities of the professorate.* Carnegie Foundation for the Advancement of Teaching.
Li, Y. (2014). International Journal of STEM Education—A platform to promote STEM education and research worldwide. *International Journal of STEM Education, 1*, 1. https://doi.org/10.1186/2196-7822-1-1

Publisher's Note