Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #45894

Creating a Culture of Coachability: The Innovation Fellows Program for Mentoring Early-Career Engineers and Scientists in Entrepreneurship and Commercialization

Anne K DeChant, Penn State University Hershey College of Medicine

Anne DeChant is the Associate Director for the Center for Medical Innovation (CMI) at Penn State University Hershey College of Medicine. Ms DeChant leads education and training programs for CMI, providing specialized programming for healthcare innovation and commercialization. Ms DeChant also manages a portfolio of therapeutics and diagnostic technologies, and provides expertise and support for translational research development, strategic planning, and implementation of major projects. Ms DeChant is a dynamic leader with 20+ years of experience in higher education, and earned her MBA at Case Western Reserve University, her MS in Cell Biology at Cleveland State University, and her BS at Ohio State University.

Prof. Erika Swift, The Pennsylvania State University College of Medicine

Erika Swift is a Professor of Practice and Center for Medical Innovation Director at The Pennsylvania State University College of Medicine. Before joining Penn State University in 2015, she worked in various industry sectors, including medical devices, dental equipment, and consumer goods. She has over 25 years of experience in regional economic development, technology commercialization, new business development, entrepreneurial coaching, and startups. She received her Bachelor's Degree in Marketing with a Concentration in International Business from Bloomsburg University, an MBA from York College of Pennsylvania, and an MHA from Penn State University.

Dr. Alyson Grace Eggleston, Pennsylvania State University

Dr. Eggleston is an Associate Research Professor with Penn State Hershey College of Medicine and Director of Evaluation for the Penn State Clinical and Translational Science Institute. A graduate of Purdue University, she earned a PhD in Language Science with a focus on language effects in spatial cognition, large language datasets, and conducted community-driven research with indigenous communities in Nicaragua. As a social scientist, she was tenured faculty at The Citadel – Military College of South Carolina and served for 8 years in advisory accreditation and evaluation roles at the pleasure of the Provost. Her research and teaching background focus on program assessment, STEM technical communication, industry-informed curricula, and educational outcomes for Veteran and active duty students.

Dr. Robert J. Rabb P.E., Pennsylvania State University

Robert Rabb is the associate dean for education in the College of Engineering at Penn State. He previously served as a professor and the Mechanical Engineering Department Chair at The Citadel. He previously taught mechanical engineering at the United States Military Academy at West Point. He received his B.S. in Mechanical Engineering from the United Military Academy and his M.S. and PhD in Mechanical Engineering from the University of Texas at Austin. His research and teaching interests are in mechatronics, regenerative power, and multidisciplinary engineering.

Mark Daniel Pacey, Pennsylvania State University

WIP: Creating a Culture of Coachability: The Innovation Fellows Program for Mentoring Early-Career Engineers and Scientists in Entrepreneurship and Commercialization

Abstract

Engineers may be regarded for their technical knowledge and creative solutions, but these skills are just as important for entrepreneurs to make strategic decisions for an organization. Engineers and entrepreneurs seek out opportunities, secure and employ resources, and provide leadership to create something of value. Engineers may lack entrepreneurship development and exposure due to curricula focused on technical content, but these very skills and mindset can be developed. A culture of coachability is a key factor in creating successful, fundable ventures. The Center for Medical Innovation's Innovation Fellows (IF) Program has developed a distinctive mentoring strategy to nurture innovation and engineering entrepreneurial mindsets in early-career engineers and scientists. This year-long program enhances expertise in engineering, life sciences, and clinical disciplines with additional training in key commercialization areas and provides multi-perspective mentorship to advance translational research and bring novel medical technologies to the marketplace.

Aligned with the newest High Impact Practices. the National Science Foundation Innovation Corps (NSF I-Corps™)-based IF Mentoring Program leverages a multiple-perspective mentoring approach to support each IF through their entrepreneurship training with three mentors: an internal SME (Subject Matter Expert) mentor, an internal innovation mentor, and an external industry mentor. The internal SME mentor serves as the IF's principal investigator to guide the translational research project and commits to attending the mentee's project presentations throughout the year. The internal innovation mentor works alongside the IF to support identifying and closing commercialization knowledge gaps and provides valuable networking leads to advance the mentees' progress. Industry mentors, selected from external advisory board member volunteers, bring an extensive network of contacts and expertise relevant to the IFs' novel technology. Using a discovery interview process and outcome-based protocol, the IF mentoring program follows a flipped classroom structure. This approach encourages IFs to develop a coachable mindset, integrate constructive feedback, and pursue opportunities for advancing their technologies during and beyond the program. Ultimately, Innovation Fellows produce solutions that are customer-focused and aligned with existing infrastructure and workflows.

This paper details the structure of the IF mentoring program, showcasing two quantitative and qualitative discovery instruments that are designed to inform continuous programmatic improvement. Preliminary pre- and post-program data is presented, capturing two cohorts of fellows' perceptions of their competencies in areas such as intellectual property and legal issues, networking, and knowledge of regulatory pathways, where a near two-fold improvement was observed.

Introduction / Background

Based on the I-Corps model implemented at NSF [1] - [3], the Innovation Fellows (IF) Program employs a multi-level, multi-perspectives approach to entrepreneurial mentoring [4] - [6]. This program is designed to bridge the gap between novel research and the Technology Transfer

Office at Penn State University, upskilling trainees in customer discovery, strategic pivots, and commercialization. I-Corps is the result of the interaction of Small Business Innovation Research and Small Business Technology Transfer, both federally mandated set-aside programs, and their awardee scientific teams. Teams are partnered with a series of industry leads that deliver subject matter expertise as well as business proposition competency [1].

Penn State University and the Center for Medical Innovation believe in being agents of social adaptation and transformation, developing critically engaged citizens whose endeavors will support the public good, now and into the future. The IF Program supports the University's Strategic Plan (2016-2025) [7] in multiple ways. As part of the Foundations of the Strategic Plan, the academic units have a responsibility to *Engage Our Students*. The IF Program provides students with access to meaningful experiences to enhance their educational journey in areas including research and professional development to grow beyond the classroom. To *Drive Economic Development*, the university will accelerate the transfer of new ideas and knowledge into useful products and processes. In an effort to *Transform Education*, the university and colleges support and empower the faculty and staff so they can be known as exemplary research mentors, instilling the value and discipline of research in our undergraduate and graduate students, and preparing the next generation of independent researchers. Moreover, Penn State University will remain committed to providing an array of co-curricular opportunities and career preparation services that will enhance students' readiness to succeed. The university will be a leader in student engaged scholarship, providing students opportunities to apply their learning in capstone and real-world settings and creating the next generation of accomplished professionals, entrepreneurs, volunteers, community leaders, and resilient lifelong learners. As part of the desired outcomes, the IF Program partners directly with our constituencies in sharing research, creative works, and scholarship for impact [7].

Innovation Fellows Model

The Innovation Fellows Model provides a framework for early-career engineers and scientists to learn about entrepreneurship, technology commercialization, and product development derived from academic research under a multiple-perspectives mentoring model [8], designed to produce more entrepreneurial aware clinicians, scientists, and engineers. The model was initially piloted by the Massachusetts Institute of Technology and enhanced by iterations at Case Western Reserve University, where it leveraged venture approaches to upskilling engineers and scientists in entrepreneurial and cross-disciplinary project applications [9] – [11]. Multiple perspective mentoring is inclusive of many kinds of expertise and this approach addresses some of the ecological concerns of mentoring where there are power differentials and the importance of recruiting mentors from all backgrounds and experiences [4]. Multilevel mentoring is an approach that corresponds with rapid, systemic change with mentors facilitating interdependence and participative leadership for mentees [5]. Hou and colleagues identify entrepreneurial opportunity awareness, or entrepreneurial cognition, as a key emerging feature of successful entrepreneurial education programs [6]. Bridging the gap from discovery research to marketable product requires the fellow to retrain their thinking from purely scientific investigation towards optimization, prototyping, and scaling up to answer important business needs and questions [12].

The overarching goals of the program are two-fold: accelerate the technologies toward exit with new knowledge and understanding of the best approach, and coach the fellow in career development to provide a more skilled and experienced workforce [13].

The program is designed as a small group learning environment with flipped classroom style teaching, mentor-fellow interactions, and self-paced work. The current cohort size is also constrained by funding limitations. Each fellow utilizes the additional funds provided by the program for product development, conference travel, and salary stipends. As such, this program constitutes significant investment in the fellows and their professional development and community networking opportunities, all while driving technology development and capture.

Fellows often self-select into the program based on their interest in innovation and prior industry careers. More senior faculty mentors and support fellows who can observe processes and 'culture' associated with the more senior faculty mentor's lab or working groups. The program enjoys a nearly 100% selection to acceptance ratio. The cohort is usually a mix of expertise levels, which allows the fellows to be engaged in near-peer mentoring [14] throughout the year. The near-peer mentoring model positions fellows to bring new teachings back to the lab where innovation-friendly research cultures can spread. In this respect, the success of the fellows is impacted by their coachability. Coachability, defined as "the tendency to be comfortable working with and willing to learn from a coach," [15] is quantifiable by a series of measures popularized in management studies and has tremendous implications for the STEM higher education landscape. By being open to new ideas and new approaches, successful fellows practice three critical 'professional skills': (1) capacity to maintain high-quality working alliances; (2) develop new thresholds for goal commitment, effort, and persistence; (3) capacity to receive feedback, evaluation, and change course of action [15].

Mentors (SME, Innovation, Industry)

The Innovation Fellows Program offers a unique opportunity for graduate students, medical students, and post-doctoral fellows across the Colleges of Engineering, Medicine, Information Science, and Science, resulting in multidisciplinary, layered, focused team mentoring. The program enlists mentors from three areas: (1) a SME; (2) an innovation mentor; and (3) an industry mentor. These mentors hail from diverse environments, specialties, and backgrounds. The SME is the principal investigator in the lab, guiding and teaching the fellow in the design and execution of experiments, and guides the fellow's innovation activities such as validation, prototyping, and product optimization. The innovation mentor is a university staff member affiliated with the Center for Medical Innovation who serves as an anchor for understanding commercialization processes, academic innovation pipelines, career development, and networking. The industry mentor is selected from a pool of alumni and university-connected biotechnology and healthcare business experts. Industry mentors provide external feedback on the fellow's product development, business plans, pitch decks, and career development, supporting both the technology and the person.

Sourcing a sustainable group of mentors can be a unique challenge to each institution. Innovation mentors are currently sourced through staff and administrative faculty with a connection to the Center for Medical Innovation. Expansion will require more human capital, which will come at a cost – mentors will either commit more time to the program or new hires will be added. Industry mentors can be identified from institution alumni lists, regional industry and corporate partners, and regional innovation ecosystem organizations such as incubators and accelerators. Industry mentoring is performed as a volunteer activity with low demands on their time, and most activities are performed via video conferencing for greater reach and engagement.

Customer Discovery Interview Utilizing a Flipped Classroom Pedagogy

As part of the Innovation Fellows Program, the fellows receive specialized customer discovery training tailored for biomedical scientists and engineers. This training builds from the U.S. NSF I-Corps Program launched in 2011. I-Corps is to prepare "scientists and engineers to extend their focus beyond the laboratory to increase the economic and societal impact of NSF-funded and other basic research projects" [16]. This methodology was adapted by the National Center for Advancing Translational Science (NCATS), offering a 5-week course specifically for biomedical scientists to address unique challenges and opportunities in the biomedical sector [17].

During orientation, the Innovation Fellows are introduced to the NCATS adaptation of I-Corps and the customer discovery process. In addition, fellows receive curated resources for independent study to learn the principles of the I-Corps methodology. To enhance learning, the IFP utilizes a flipped-classroom approach, which reverses traditional teaching methods of lectures followed by learning activities but instead provides preliminary training materials before class and engages in active learning during the class session [18]. The Innovation Fellows present findings from their customer discovery interviews in class. They then participate in collaborative exercises, group discussions, and mentor-led breakout sessions to examine specific findings from their customer discovery interviews. This analysis of collected interview insights promotes deeper understanding and practical application to their technology project.

The Innovation Fellows Program's adaptation of the I-Corps customer discovery is intentionally paced to support early-career innovators. By pacing the program to build foundational skills and confidence, Innovation Fellows learn to engage potential customers and stakeholders from diverse, non-academic backgrounds. The combination of this flipped classroom approach and active mentorship fosters a coachable mindset. This equips Innovation Fellows to navigate research translation to commercialization through learning from non-academic stakeholders with mentorship and ultimately advance their innovations effectively.

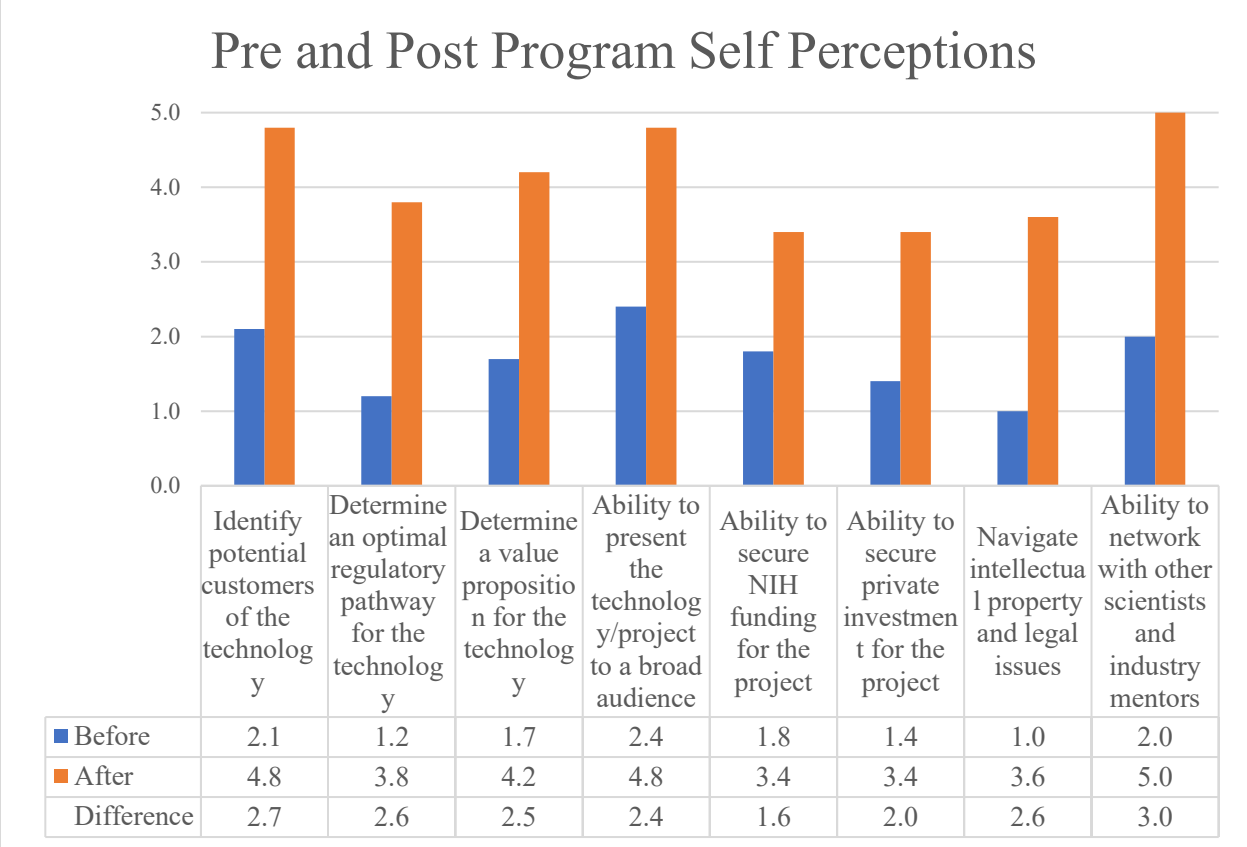
Analysis

Piloting an initial assessment of the Innovation Fellows Program, leadership was interested in quantifying fellows' initial self-estimations of their innovation and technology development skills along eight dimensions. Fellows were asked to rate their capacity to execute the following

skills on a 1-5 Likert scale, with 1 – Not at all confident and 5 – Extremely confident. Those dimensions are listed below:

1. Identify potential customers of the technology
2. Determine an optimal regulatory pathway for the technology
3. Determine a value proposition for the technology
4. Ability to present the technology / project to a broad audience
5. Ability to secure NIH funding for the project
6. Navigate intellectual property and legal issues
7. Ability to network with other scientists, engineers, and industry mentors

Across these eight dimensions, the fellows pre-program estimations were relatively low. Figure 1 below provides a comparison of pre-program (blue) and post-program (orange) assessment. On average, fellows rated their abilities between 1.0 - 2.4 (Not at all confident to Not confident) before program-start. Post-program scoring along the same dimensions showed a 1.6 - 2.8-point increase on any dimension with resulting scores ranging from 3.4 - 5 (Neutral to Extremely confident).



	Identify potential customers of the technology	Determine an optimal regulatory pathway for the technology	Determine a value proposition for the technology	Ability to present the technology/project to a broad audience	Ability to secure NIH funding for the project	Ability to secure private investment for the project	Navigate intellectual property and legal issues	Ability to network with other scientists and industry mentors
Before	2.1	1.2	1.7	2.4	1.8	1.4	1.0	2.0
After	4.8	3.8	4.2	4.8	3.4	3.4	3.6	5.0
Difference	2.7	2.6	2.5	2.4	1.6	2.0	2.6	3.0

Figure 1. Innovation Fellows Pre- and Post-Program Perceptions with Average Change Overlay Plot.

Fellows post-program score distributions were also weighted toward the 4's and 5's as shown in the scoring distribution plot in Figure 2. Of note, all Fellows provided 5's (Strongly Confident) in their ability to network with industry stakeholders, post-program.

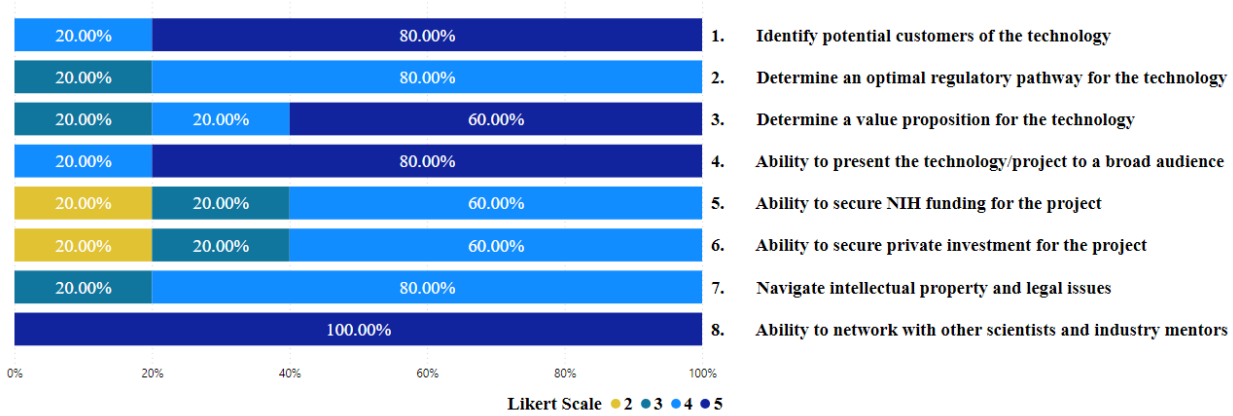


Figure 2. Innovation Fellows Post-Program Perceptions with Likert Score Distributions.

Discussion

Creating a scalable model of the Innovation Fellows requires adapting practices to each institution's strengths. Courses will be tailored to strategic needs, as an engineering-heavy program can operate on different parameters than a therapeutics-focused organization. Mentor recruitment must take advantage of unique institutional relationships, resources, and partnerships. A culture of innovation will support more Subject Matter Experts who are open to innovation programming. Providing operational resources to support innovation mentors will increase capacity for fellows. Most institutions will be able to identify and recruit industry mentors from a variety of sources, including alumni groups, corporate partners, regional industry experts, and the local innovation ecosystem of incubators and accelerators. However, recruiting does not have to be limited by geographic distance, as most of the activities are performed via video conferencing. If a strong connection to expertise is available across time zones, those mentors can be accommodated.

Emerging mentor models flip the script on traditional top-down mentoring with new emphasis on near-peer cohorts, multiple perspectives, and migrating flipped classroom pedagogy to the board room or intellectual property office. Moving forward, the Innovation Fellows Program is interested in assessing mentors as predictors of next-generation technology development and capture. Using AI-assisted faculty outcomes data including patents, policy impacts, and h-indices combined with an in-house screening tool still in development, the Innovation Fellows Program looks to quantitatively screen for effective faculty mentors while also identifying predictive factors for success.

Conclusions

Leveraging near-peer and multiple perspectives mentoring models with regular, quantitative 'check-ins' for both mentors and fellows is one way to ensure continued project team success. University and business leadership is increasingly interested in coachability metrics, an exciting current topic in management science [15]. Developing an in-house screening tool based on the coachability metrics of: (1) capacity to maintain high-quality working alliances; (2) developing new thresholds for goal commitment, effort, and persistence; (3) capacity to receive feedback, evaluation, and change course of action, would allow program leadership to continue improving selection and support of successful mentors while growing the technology development enterprise.

References

[1] C.A. Canaria, L. Portilla, and M. Weingarten, "I-Corps at NIH: entrepreneurial training program creating successful small businesses." *Clinical and Translational Science*, 12.4: p. 324, 2019.

[2] M.S. Ahmed, "Lessons Learned from NSF I-Corps Boot Camp," *Journal of Education and Practice*, 8(26), pp. 1-10, 2017.

[3] K.A. Smith, A.F. McKenna, R.C.C. Guerra, R. Korte, and C. Swan, "Innovation Corps for Learning (I-Corps™ L): Assessing the potential for sustainable scalability of educational innovations," *Proceedings of the 2016 ASEE Annual Conference & Exposition*, June 26-29, 2016, New Orleans, LA.

[4] J.L. Mondisa, B.W. Packard, and B.L. Montgomery. "Understanding what STEM mentoring ecosystems need to thrive: A STEM-ME framework." *Mentoring & Tutoring: Partnership in Learning* 29.1: pp. 110-135, 2021.

[5] C.A. Mullen and C.C. Klimaitis, "Defining mentoring: a literature review of issues, types, and applications," *Annals of the New York Academy of Sciences*, 1483(1), pp. 19-35. 2021.

[6] F. Hou, Y. Su, M. Qi, J. Chen, and J. Tang, "A multilevel model of entrepreneurship education and entrepreneurial intention: Opportunity recognition as a mediator and entrepreneurial learning as a moderator," *Frontiers in Psychology*, 13, 837388. 2022.

[7] (2016) Our Commitment to Impact. [Online]. Available: https://cpb-us-e1.wpmucdn.com/sites.psu.edu/dist/d/114442/files/2020/02/Our-Commitment-to-Impact-2016-2025.pdf

[8] T.D. Allen and L.T. Eby (Eds.), *The Blackwell Handbook of Mentoring: A Multiple Perspectives Approach,* John Wiley & Sons, 2011.

[9] C.L. Thompson, T.A. Misko, and M.R. Chance, "Training the next generation of translational scientists: The Case Western Reserve University translational fellows program," *Journal of Clinical and Translational Science*, vol. 6(1), e47, 2022.

[10] M. Wasko, K.A. Nearing, S.L. Neves, A. Carrillo, J. Rainwater, J.A. Croker, and R.P. Kimberly, "Training T-shaped translational scientists," *Journal of Clinical and Translational Science*, pp. 1-19, 2025.

[11] (2025) MIT Venture Mentoring Service. [Online]. Available: https://vms.mit.edu/

[12] T.C. Ambos, K. Mäkelä, J. Birkinshaw, and P. d'Este, "When does university research get commercialized? Creating ambidexterity in research institutions," *Journal of Management Studies*, 45(8), pp. 1424-1447, 2008, https://doi.org/10.1111/j.1467-6486.2008.00804.x

[13] A.A. Seyhan, “Lost in translation: the valley of death across preclinical and clinical divide–identification of problems and overcoming obstacles,” *Translational Medicine Communications*, 4(1), pp. 1-19, 2019.
[14] C.C. Happel and A. Cicchino, “Enhancing Faculty Engagement: The Role of CTLs in Providing Peer Mentorship for New Faculty,” *The Journal of Faculty Development*, 37(3), pp. 84-88, 2023.
[15] M.J. Johnson, K.H. Kim, S.M. Colarelli, and M. Boyajian, “Coachability and the development of the coachability scale,” *Journal of Management Development*, 40(7/8), pp. 585-610, 2021.
[16] NSF, “NSF I-CORPS,” https://new.nsf.gov/funding/initiatives/i-corps. [Accessed January 14, 2025].
[17] K. Nearing, J. Rainwater, S. Neves, P. Bhatti, B. Conway, B., N. Hafer, ... and M. Wasko, "I-Corps@ NCATS trains clinical and translational science teams to accelerate translation of research innovations into practice,” *Journal of Clinical and Translational Science*, 5(1), e66, 2021.
[18] I.T. Awidi and M. Paynter, "The impact of a flipped classroom approach on student learning experience,” *Computers & Education*, 128, pp. 269-283, 2019.