R1 and R2 Collaboration and Exchange: The Journey Towards a Practicum Experience

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Abstract

This paper documents the early collaboration process between Michigan Technological University (R1) and Hofstra University (R2) as one of the authors, a graduate student at R1, embarks on a *Practicum* at R2. The practicum requirement predicated the collaboration; allowing for cross-pollination of ideas and strategies. The hosting of a Michigan Tech student for a practicum was a new opportunity for Hofstra, which posed several challenges. In this paper, we document the events leading to the collaboration, the reciprocal mentoring between Michigan Tech and Hofstra faculty, the benefits and challenges of instituting a collaboration between the two universities and a path for a practicum to occur. The practicum provides a unique opportunity for the graduate student to participate in a university department as adjunct faculty; teaching undergraduate courses, conducting research, and engaging in service activities.

The practicum seeks to foster inter-institutional collaboration through the exchange of research and experiences. A principal component of the research exchange facilitated by the practicum is the introduction of a pedagogical tool into classrooms at R2. The tool, developed in R1, aims to improve novice programmers' skills by offering real-time feedback during coding. This tool serves as a vehicle for the graduate student's work, which is broadened and deepened through the practicum. An outcome of this collaboration at the R2 institution is the formation of a committee to streamline the process for inviting and hosting students and visiting researchers.

Introduction

Motivating Problem

The central motivating problem behind our research is the persistent challenge of effectively teaching programming skills to different student populations, particularly in high school and first-year university engineering courses. Traditional methods of instruction often struggle to provide timely, personalized feedback, which is crucial for helping students grasp complex programming concepts. Many students experience frustration and disengagement due to the delayed nature of feedback in large classes, which can hinder their learning and reduce their confidence in their programming abilities. Furthermore, the growing demand for programming literacy across disciplines, from engineering to the broader STEM fields, makes it imperative to find scalable, efficient solutions to improve programming education at all levels.

Tools that can bridge the gap between individualized instruction and the realities of large-scale, diverse classrooms are in high demand. Current educational approaches often lack the flexibility and adaptability needed to cater to different students' ranging interests, preferences [1] and paces, particularly in introductory programming courses where students' prior experience can vary widely. The challenge extends to K-12 education, where exposure to programming is often limited, and the development of foundational computational thinking skills is critical. We seek to address these issues by leveraging our WebTA code critiquing software to provide real-time, automated feedback, to enhance programming instruction and better support student learning and engagement across different academic contexts.

We see a need for collaborative frameworks between universities that allow for successful exchange of pedagogical practices and innovative technologies. The lack of such cross-institutional partnerships often leads to siloed educational advancements, limiting the broader impact of promising tools like WebTA. This project aims to address this gap by fostering a partnership between Michigan Technological University and Hofstra University, creating a model for how institutions can collaboratively improve programming education through shared resources, research, and innovation.

Practicums and their importance

Practicums are common in the science and medical fields. In general, the purpose of a practicum is to assess competency in a given area. For example, as an undergraduate, one may have been required to take a "practicum (exam)" in a microbiology course to demonstrate knowledge and laboratory skills. A practicum can be considered a clinical rotation in the medical field but not all clinical rotations are practicums. The 2009 special issue of Training and Education in Professional Psychology mentions three levels of preinternship training for doctoral trainees: prepracticum, internal practicum and external practicum with the latter consisting of placements in medical centers, community mental health, veterans affairs medical center, correctional, child outpatient, private outpatient, university counseling center, and psychiatric hospital. [2]

What makes this practicum unique is that the grad student has organically evolved from a BS in Computer Science into Psychology and Human Factors for MS and PhD. She is applying her programming skills to enhancing the user learning experience and thereby blending Computer Science, Psychology, and Human Factors into a new area of expertise. However, we are faced with an existing infrastructure whereby PhD candidates are required to complete a practicum which is a natural fit for Psychology and Human Factors but not necessarily for Computer Science. Herein lies the challenge and the motivation for this paper. What does a practicum for a computer science turned psychology and human factors PhD look like? What does it entail? What competencies are we measuring and why?

Direction for developing the details of the practicum began with the requirement put forth in the Student Handbook for the Applied Cognitive Science & Human Factors (ACSHF) at MTU, *"The practicum requirement is an independent activity wherein you will (1) apply existing ACSHF knowledge and skills and (2) acquire new knowledge, skills, and methods from the operational setting in which the practicum activity takes place"* [3]. There was a great deal of flexibility in creating the practicum with encouragement to make this an external practicum. Leaving MTU and spending a semester visiting another university seemed a good fit. Hence began the journey to establishing the practicum at Hofstra University.

Methodology

Administrative Journey

The authors sought to document the process of establishing a symbiotic relationship between the R1 and R2 Universities by sharing best practices, and lessons learned in this paper as a reference for other R1 and R2 collaborations. Perhaps this will inspire other engineering fields to incorporate a practicum requirement into the PhD process. When it was decided that the grad student would fulfill her practicum at the R2 University, the untenured R2 faculty began investigating how to make this happen. There was no precedent within the department and therefore, no existing processes or procedures. She emailed a social support group (of primarily Science and Math faculty) at the university and received two replies. Both colleagues had invited post docs as "Visiting Researchers." So, there was a process for bringing and housing someone with a PhD as a STEM visiting researcher but not for bringing and housing a PhD student from another university to satisfy their practicum in a STEM field. Another colleague suggested hiring the grad student as an Adjunct Instructor. This would help provide the teaching experience needed to fulfill the practicum while providing a small paycheck. This idea was presented to the Dean who approved it immediately.

The R2 restricts adjuncts to eight credits of teaching per semester and thus the process began to ensure the PhD student would have at least two courses, maybe three. Because the grad student's research in WebTA aligned with the R2 faculty member's first-year programming for engineers curriculum and she was scheduled to teach two sections, it was easy to release one section (three-credits) to the grad student. Administratively, the PhD student and R2 faculty would co-teach both sections and therefore, on the books, they each were given 1.5 credits of each course. Thankfully, the R2 faculty had been slated to teach four, three-credit courses during the Spring 2025 semester and could easily release one while still satisfying the union requirement of nine credits per semester. Given Laura's strong computer science background, attempts were made to have her teach a three-credit course in the computer science department but all teaching needs had been filled. By luck, the R2 faculty attended a Girl Scout fundraising event with the Psychology Department Chair and during the conversation learned that there was a need to teach Python to Psychology majors. While only one credit, the grad student now had four credits and full autonomy over designing and developing the Python for Psychology Majors course. The Engineering Department provided the appointment letter and served as the "home" department.

ASEE Conferences and the Power of Networking

The American Society for Engineering Education (ASEE) First Year Engineering Experience (FYEE) in 2023 at the University of Tennessee at Knoxville marks the inception of this research collaboration journey. Laura, a graduate student from Michigan Technological University, presented a poster and lightning talk [4] on the beginnings of her master's thesis work [5]. Dr. Lynn Albers listened to the presentation and proceeded to hand Laura her business card because she felt that Laura's work would complement her newly designed pedagogy using active learning to introduce students to Excel and MATLAB. [6, 7, 8] From there, Laura immediately sought the advice of her advisor, Dr. Leo Ureel, who instructed her to send an email and pursue that connection. The following months involved numerous emails, which further introduced Lynn to Leo and Laura's work on the code critiquing tool WebTA [9, 10], as well as the rest of their research team.

MOU and IRB

In order to protect the grad student's and her advisor's intellectual property, both sides discussed implementing a Memorandum of Understanding (MOU) and that it should be initiated from the R1 institution. Further discussion led to the realization that the R2 faculty should protect their research based, newly designed pedagogy and therefore, the MOU should serve both parties in this capacity. The R1 institution initiated the MOU by emailing a boiler plate template to the R2 institution where it was reviewed, modified and returned to the R1 where the changes are currently under review. Both parties made changes until satisfied. This was a lengthy process that should be started at least 6 months before the intended start date.

Several IRBs were implemented in order to cover all bases. The R1 amended their IRB to include the R2. The R2 faculty amended an existing IRB to cover the research on WebTA in the Computer Programming for Engineers course. Since the Psychology course was new, a new IRB exemption request was made to cover the research being conducted in that course and to provide the necessary documentation to the R1 confirming that they could recruit both engineering and psychology majors at the R2 for their study.

The Practicum Described

The practicum project will establish a cross-institutional collaboration between Michigan Tech University and Hofstra University, focusing on enhancing programming education for K-12 and first-year engineering students. The collaboration has multiple components:

1. **Curriculum Exchange:** Michigan Tech and Hofstra will share teaching materials, pedagogical frameworks, and instructional strategies aimed at improving programming education. The curriculum exchange will focus on leveraging each institution's strengths to optimize teaching methods for diverse student populations, including K-12 outreach programs and introductory engineering courses at the university level. The graduate student will teach 2 courses at Hofstra during the practicum.WebTA will be implemented into both of these courses.

2. **Michigan Tech's WebTA Deployment at Hofstra University:** WebTA, an automated code critiquing tool developed at Michigan Tech, will be deployed at Hofstra during the Spring and Fall 2025 semester. Laura Albrant, a PhD student from Michigan Tech, will assist in this deployment. WebTA will be integrated into two courses—Computer Programming for Engineers and First-Year Engineering Design. In these courses, WebTA will provide real-time feedback to students, improving their programming skills and self-efficacy through continuous formative assessment. Additionally, Laura Albrant will co-teach these courses alongside Dr. Lynn Albers, providing valuable teaching experience while conducting research on the tool's impact in a new institutional setting.

3. **Faculty Exchange and Collaborative Innovation:** Both institutions will host reciprocal

visits during Spring and Fall breaks in 2025 to facilitate hands-on collaboration and curriculum alignment. Dr. Leo Ureel will visit Hofstra to support the WebTA deployment and offer workshops on its use, while Dr. Lynn Albers will visit Michigan Tech to exchange ideas on integrating human factors and usability studies into STEM education. This exchange will foster the development of new pedagogical strategies and tools that benefit both K-12 students and first-year university engineering students.

4. **Funding Proposals and Dissemination:** The practicum will culminate in two major funding proposals—(1) an NSF-IUSE Level 2 to scale dissemination efforts and expand research, (2) an NSF-DRK12 to explore the potential of WebTA in K-12 programming outreach. Furthermore, the project aims to produce at least three peer-reviewed academic papers based on the deployment, effectiveness, and scalability of the WebTA system.

5. **Graduate Student Accommodations:** Hofstra University is able to hire Laura for the Spring 2025 semester as a part-time (4 credits) Adjunct Instructor. We were unable to procure reduced on-campus housing, but the R2 faculty found inexpensive off-campus housing which was offered to and accepted by the graduate student. The general population size and cost of living from Houghton, MI to Hempstead, NY was a cost-prohibitive difference. The offer of inexpensive off-campus housing made the transition feasible and practicum possible.

Partnership Rationale

We believe the partnership will significantly benefit both institutions by expanding their capacity to teach programming and computer science in innovative ways. For Michigan Tech, deploying WebTA in a new academic environment will provide valuable insights into the system's adaptability and effectiveness across different student populations. Data from the deployment will be used to assess WebTA's impact on student learning outcomes at Hofstra and will contribute to ongoing research on the tool's scalability and adaptability.

For Hofstra University, this collaboration offers an opportunity to integrate advanced pedagogical tools into their curriculum while establishing a research partnership with Michigan Tech. Additionally, the presence of Laura Albrant as an adjunct instructor will enhance their faculty's capacity for research in the areas of human factors and usability studies, complementing their ongoing development of a cross-disciplinary program in this field.

The WebTA system has demonstrated significant benefits in the realm of computer science and engineering education, particularly for novice programmers. Early programming courses are known to present considerable challenges for students, with high dropout rates and frequent struggles to overcome the steep learning curve of programming languages. The lack of immediate, relevant feedback further exacerbates these challenges. WebTA addresses this gap by offering timely, automated feedback through a code critiquing tool that highlights antipatterns—common student mistakes that experts would avoid [11, 12]. The potential of WebTA to impact programming education beyond college-level introductory courses remains largely unexplored. This project aims to develop a dissemination model for WebTA that enables educators in both higher education and K-12 settings to benefit from this pedagogical innovation.

Novelty of the Project

This project's novelty lies in its dual focus on both expanding the pedagogical reach of WebTA and developing a systematic approach to disseminating technological innovations across diverse educational contexts. The combination of real-time code critique, antipattern analysis, and faculty-student collaboration creates a unique model for programming education.

Three key aspects contribute to the novelty of this project:

1. **Cross-Institutional Collaboration for Scalability:** By partnering with Hofstra University, this project will explore how WebTA can be adapted for different educational contexts, such as advanced courses in computer science and engineering. The collaboration between institutions, facilitated by faculty exchanges and graduate student research, creates a model for broad adoption and scalability.

2. **Real-time Antipattern Feedback:** WebTA provides immediate, detailed feedback to students by detecting antipatterns, or common programming errors, that often impede novices [13]. Unlike autograders that simply evaluate code outputs, WebTA helps students understand underlying design issues in their code—an approach that fosters deeper learning and encourages better programming practices.

3. **K-12 Outreach:** The proposed NSF-DRK12 funding will support using WebTA in K-12 settings, where programming is increasingly recognized as a critical skill. Early exposure to programming concepts through tools like WebTA can significantly enhance problem-solving and computational thinking skills [14].

Benefits to Faculty and Institutions

By providing real-time, automated feedback on student programming assignments, WebTA enhances learning by fostering iterative problem-solving and self-correction. This practicum extends NSF funded research conducted at Michigan Technological University by the PI. Deploying WebTA at Hofstra University will expand the tool's impact, allowing researchers to study its effectiveness across diverse student populations and new academic settings, contributing to the growing body of research on automated critique tools.

This practicum also contributes to the advancement of programming pedagogy by integrating automated feedback systems into K-12 and first-year engineering curricula. Through a collaborative curriculum exchange between Michigan Technological University and Hofstra University, the project will develop best practices for using tools like WebTA to improve student engagement and learning outcomes. By involving interdisciplinary research in human factors and usability studies, the initiative will explore the cognitive and ergonomic aspects of programming education, enriching research on human-computer interaction (HCI) and educational technology.

Finally, the cross-institutional deployment of WebTA will generate empirical data on the tool's scalability and adaptability. This will offer valuable insights into how automated feedback systems can be effectively transferred to different educational contexts. The project's findings will be disseminated through publications and presentations, advancing knowledge in the fields of intelligent tutoring systems, STEM education, and interdisciplinary approaches to human-centered design.

By fostering collaboration and generating new research, this project will lay the groundwork for future innovations and external funding opportunities in educational technology.

Anticipated Impact

The proposed collaboration between Michigan Technological University and Hofstra University will have significant impacts on both institutions, their students, and the broader educational technology community. By deploying WebTA at Hofstra, this project will enhance programming education and contribute to improved learning outcomes for K-12 and first-year engineering students. Furthermore, the cross-institutional exchange of curriculum and teaching methodologies will foster innovation in STEM education, aligning with both universities' strategic goals. This initiative will also generate valuable data and insights that will inform future research and grant opportunities, positioning both institutions as leaders in the integration of AI-driven tools in education. Specific long-term impacts include:

1. **Research Expansion:** By introducing WebTA to a new academic institution, this project will expand the body of research surrounding automated feedback systems in education. The project will produce two to three publications, including one on WebTA's deployment at Hofstra and another analyzing its impact on student learning.

2. **Career Development:** The project will support the PI's research trajectory by generating new data for future studies and publications, positioning him for additional external funding opportunities. For Laura Albrant, the practicum will provide invaluable teaching and research experience that will further her academic career, particularly as she prepares for a future professorship.

3. **Institutional Impact:** This collaboration aligns with Michigan Tech's Tech Forward initiatives by promoting innovative teaching practices in STEM education, emphasizing the role of AI in educational settings, and supporting the university's commitment to excellence in teaching and learning. At Hofstra University, this project will contribute to the expansion of their human factors and usability studies program, enhancing their interdisciplinary approach to engineering education.

4. **Broader Adoption of WebTA in Higher Education:** By expanding WebTA to advanced programming courses, this project will address the growing need for more effective programming education tools. With increasing class sizes in computing disciplines, tools like WebTA can significantly enhance learning by offering students personalized feedback that instructors may not have the capacity to provide [15]. The dissemination model developed through this collaboration will make it easier for other institutions to adopt WebTA and integrate it into their curricula.

5. **Broadening Participation in STEM:** The use of WebTA in K-12 programming outreach holds promise for increasing participation in STEM fields, particularly among underrepresented groups. Early exposure to coding, combined with immediate feedback mechanisms, can demystify programming and make it more accessible [16]. This could play a significant role in addressing the diversity gap in computer science by encouraging more students from varied backgrounds to pursue STEM careers.

6. **Enhancing Programming Competencies:** The immediate feedback provided by WebTA improves students' understanding of key programming concepts, leading to higher retention rates in computer science courses. Studies show that timely feedback not only improves student performance but also boosts self-efficacy and confidence in programming [17]. Through this project, WebTA will be optimized to serve both novice and advanced learners, providing a continuous scaffold for their development into proficient programmers.

Practicum Plan

The *Collaboration and Exchange: The Journey Towards a Practicum Experience* project will be conducted through a structured, multi-phase approach to ensure thorough development, evaluation, and dissemination of WebTA across both higher education and K-12 settings. The project comprises five primary tasks, each aligned with clearly defined objectives, timelines, and deliverables.

Task 1: Development of Research Dissemination Framework

In this phase, the project team will create a scalable dissemination framework for the WebTA system. This framework will be informed by previous research in the field of educational technology dissemination, particularly models that emphasize scalability and adoption in diverse educational environments [18, 19]. The framework will outline strategies for faculty on-boarding, curriculum integration, and adaptation of WebTA for different programming languages and educational contexts.

Task 2: Faculty and Student Exchange

To facilitate cross-institutional collaboration and research, the collaboration will include a research practicum at Hofstra University for PhD student Laura Albrant and reciprocal visits by R1 faculty Leo Ureel and Lynn Albers during Spring 2025. These exchanges will focus on hands-on research, adapting WebTA for different instructional settings, and refining pedagogical materials for both novice and advanced programmers.

Task 3: K-12 Programming Outreach

One of the project's key innovations is the adaptation of WebTA for K-12 programming education, an area that has seen limited application of real-time, automated code critique tools. This task will involve designing instructional materials for K-12 students and training K-12 teachers to integrate WebTA into their curricula. The project team will apply a design-based research (DBR) approach, iteratively refining both the tool and instructional strategies through classroom implementation and feedback [20].

Task 4: Funding Proposal Development

The project will culminate in three major funding proposals: an NSF-IUSE Level 2 proposal for scaling WebTA in higher education, an NSF-DRK12 proposal for applying WebTA in K-12 outreach, and a Department of Education, Education Innovation and Research (EIR) Program proposal. The development of these proposals will be informed by the results of pilot studies conducted throughout the project.

Task 5: Research and Dissemination

Funding Program	Focus Area	Proposal Goal
NSF: Improving Undergraduate STEM Education (IUSE) Level 2	Higher Education	Expanding WebTA's implementation in diverse higher education institutions to enhance programming education at scale.
NSF: Discovery Research K-12 (DRK-12)	K-12 Education	Implementing WebTA in K-12 classrooms to promote early computational thinking and problem-solving skills.
Department of Education: Education Innovation and Research (EIR) Program	Innovative Teaching Technologies	Scaling WebTA as a tool for personalized learning in computer science, particularly for under-served communities.

The project team will publish at least three peer-reviewed papers detailing the effectiveness, scalability, and impact of WebTA in both higher education and K-12 settings. Additionally, findings will be presented at conferences such as the American Society for Engineering Education (ASEE) and the ACM Technical Symposium on Computer Science Education (SIGCSE).

Interdisciplinary Contributions

The results of this project will contribute to interdisciplinary research by connecting the fields of computer science, engineering, and education. Specifically: **Computer Science:** The development of antipattern taxonomies and real-time feedback mechanisms will advance the field of educational technology. **Human Factors Psychology:** Insight into students' and instructors' user experience with a code critiquer (i.e. a programming education tool). **Engineering:** Research on the impact of real-time feedback on student self-efficacy and learning outcomes will provide insights into first-year engineering learning processes. **Education:** The project will contribute to curriculum development by providing teachers with scalable tools that can be used in both traditional and online learning environments.

Timeline

Milestone	Activity	Target Completion
January 2025	Practicum Starts. Graduate students assumes role of Adjunct Instructor.	End of May 2025
April 2025	Completion of Research Interventions and Data Collection	End of April 2025
May 2025	Analysis of Intervention Results and Initial Drafts of Proposals	Mid-May 2025
June 2025	Submit NSF-IUSE Level 2 Proposal	End of June 2025
August 2025	Submit NSF-DRK12 Proposal for K12 Outreach	Early August 2025
October 2025	Submit Department of Education EIR Proposal	End of October 2025
November 2025	Begin Collaboration with Additional Institutions for Proposal Support	November 2025

To date, progress has been made for Tasks 1, 2, and 5.

For Task 1, the project team continues their diligent efforts. Observational notes from the PhD student's experience in the classroom have framed the near and far future developmental steps in a clearer picture.

For Task 2, it is fortunate both universities operate on a two-semester, 15-week schedule with a one-week spring break. Initially, there were plans for the faculty to visit each other's university during respective spring breaks to exchange ideas, and further collaborate on papers and grants. However, given the timing, the weather, and illness, these plans were delayed. There is a tentative rain check for late summer or during the coming Fall semester.

For Task 5, the aforementioned notes and other data gathered during this semester will be ready for analysis on schedule for May and June of 2025.

Additional progress includes the valuable experience with teaching and networking the PhD student continues to gain. Co-teaching with the R2 faculty has elucidated the grad student on teaching styles, classroom management, and the benefits of a research-based pedagogy and active learning. The experience has shown the grad student the importance of adapting to students' individual paces and exhibiting a level of patience and care needed to foster a supportive and engaging learning environment. Furthermore, the PhD student was able to aid with running a symposium for Human Factors and Usability Studies. During which, an opportunity to tour the lab of a renowned Human Factors professor and researcher arose. The student plans to take full advantage of the opportunity.

Conclusion

The *R1 and R2 Collaboration and Exchange: The Journey Towards a Practicum Experience* project leverages a proven pedagogical tool, WebTA, and aims to disseminate it through strategic partnerships and outreach.

The planning to create this practicum was started a year prior to the anticipated start date. There was no precedent and therefore no processes and procedures to follow. It has been a huge learning curve not only for the faculty and grad student but also for the administration and support services at each university. The MOU process has taken much longer to complete than expected but once in place, it will serve well as a template and resource for other R1 and R2 collaborations of this nature. Now that processes are in place, the R2 university is set up to accept more PhD students needing to complete a practicum.

By developing a scalable model for practicum experiences and further adopting WebTA across educational institutions and introducing it into K-12 outreach, this project will have significant long-term benefits for programming education. The cross-institutional collaboration and emphasis on inclusion in STEM fields align with national efforts to improve computational literacy and prepare the next generation of innovators and problem-solvers.

This journey of a practicum has been eye-opening for the PhD student, to say the least. Lessons learned from the PhD student:

- When choosing an advisor, committee member, and/or mentor, choose the ones who will lift you up, challenge you, and care about your well-being.
- Take every opportunity that arises and make time for exploration (who needs sleep, anyway?).
- Talk to people. The best ideas and collaborations can come from the most nonchalant of moments.
- In regards to pursuing a collaboration, be persistent, adaptable, and patient.
- If it interests you, try it.
- Stay connected to those you love and care about while away from home and lean on your support systems as needed.
- Do it scared and follow through.

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References

[1] R. M. Felder, B. A. Soloman, *et al.*, “Learning styles and strategies,” 2000.

[2] S. D. Price, J. L. Callahan, and R. J. Cox, “Psychometric investigation of competency benchmarks.,” *Training and Education in Professional Psychology*, vol. 11, pp. 128–139, Aug. 2017.

[3] Michigan Technological University Department of Psychology & Human Factors, *Graduate Student Handbook Applied Cognitive Science & Human Factors MS and PhD Programs*, 2023.

[4] L. Albrant, P. Pendse, M. E. Benjamin, M. E. Jarvie-Eggart, J. Sticklen, L. E. Brown, and L. C. Ureel II, “Borrowing from computer science: Cs approaches to first year engineering,” in *Submitted to ASEE First-Year Engineering Experience (FYEE) 2023*, (Knoxville, Tennessee), American Society for Engineering Education, American Society for Engineering Education, July 2023.

[5] L. E. Albrant, “Enhancing students’ user experience with a code critiquer,” Master’s thesis, Michigan Technological University, Houghton, MI, September 2024.

[6] L. Albers, “WIP: Activity Centric Online Teaching and Learning with MATLAB,” in *15th Annual First-Year Engineering Experience Conference (FYEE) Proceedings*, (Boston, Massachusetts), p. 48635, ASEE Conferences, July 2024.

[7] L. Albers and R. Puerzer, “Board 108: Development of an Activity Centric Engineering Course to Teach Excel, MATLAB, and Engineering Math for High School Students (Work In Progress),” in *2019 ASEE Annual Conference & Exposition Proceedings*, (Tampa, Florida), p. 32180, ASEE Conferences, June 2019.

[8] L. Albers, “Bungee Action Figure Activity used to Gently Introduce Students to Excel and the MATLAB IDE (Resource Exchange),” in *2022 ASEE Annual Conference & Exposition Proceedings*, (Minneapolis, MN), p. 41273, ASEE Conferences, Aug. 2022.

[9] L. C. Ureel and C. R. Wallace, “WebTA: Online Code Critique and Assignment Feedback,”

in *Proceedings of the 49th ACM Technical Symposium on Computer Science Education*, pp. 1111–1111, 2018.

[10] L. C. Ureel II, "Integrating a Colony of Code Critiquers into WebTA," in *Seventh SPLICE Workshop at SIGCSE 2021 "CS Education Infrastructure for All III: From Ideas to Practice"*, 2021.

[11] L. C. Ureel II, *Critiquing Antipatterns In Novice Code*. PhD thesis, Michigan Technological University, Houghton, MI, Aug 2020.

[12] L. C. Ureel II, "Mining intro cs program submission data." Presented at the Works In Progress Workshop of the fifteenth annual ACM International Computing Education Research (ICER) conference, Toronto, ON, Canada, 12-14 August, 2019, Aug 2019.

[13] L. C. Ureel II and C. Wallace, "Automated critique of early programming antipatterns," in *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, pp. 738–744, 2019.

[14] M. Guzdial, *Learner-centered design of computing education: Research on computing for everyone*. Morgan & Claypool Publishers, 2015.

[15] S. H. Edwards and M. A. Perez-Quinones, "Web-cat: automatically grading programming assignments," in *Proceedings of the 13th annual conference on Innovation and technology in computer science education*, pp. 328–328, 2008.

[16] J. Margolis, *Stuck in the shallow end, updated edition: Education, race, and computing*. MIT press, 2017.

[17] V. Ramalingam and S. Wiedenbeck, "Development and validation of scores on a computer programming self-efficacy scale and group analyses of novice programmer self-efficacy," *Journal of Educational Computing Research*, vol. 19, no. 4, pp. 367–381, 1998.

[18] E. M. Rogers, A. Singhal, and M. M. Quinlan, "Diffusion of innovations," in *An integrated approach to communication theory and research*, pp. 432–448, Routledge, 2014.

[19] C. Dede, *Scaling up: Evolving innovations beyond ideal settings to challenging contexts of practice*. na, 2006.

[20] A. L. Brown, "Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings," *The journal of the learning sciences*, vol. 2, no. 2, pp. 141–178, 1992.