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Design and Implementation of an Industry Mentorship Program in a First-Year Bachelor of Science in Engineering Technology Course

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Abstract

This paper presents the design, implementation, and outcomes of an industry mentorship program integrated into the introductory Engineering Technology course at a regional campus of a flagship public university. Grounded in experiential learning and constructivist pedagogical theories, the program aims to bridge the gap between academic learning and real-world industry practices by pairing first-year students with engineers from multiple manufacturing companies who volunteer as mentors. The primary objectives of the program are to enhance students' understanding of industry-relevant skills, familiarize them with industry-specific terminology, and develop their professional communication skills. Furthermore, the program focuses on improving students' ability to effectively communicate technical concepts to non-technical audiences, fostering teamwork, and encouraging self-assessment of leadership abilities in group environments.

The mentorship program follows Kolb's experiential learning theory, which emphasizes learning through concrete experiences and reflection, enabling students to apply theoretical knowledge to practical, industry-related challenges. Additionally, Vygotsky's social constructivism informs the structure of the program, where students actively construct knowledge through social interactions with their mentors and peers, providing a collaborative learning environment.
Since its implementation, the program has engaged sixteen industry professionals as mentors. Students are required to meet with their mentors at least three times during the semester, participating in structured activities such as company tours, project discussions, and professional development workshops. These interactions allow students to gain firsthand insights into industry expectations and professional environments.

Beyond enhancing student learning, the mentorship program fosters strong industry-academia collaborations, raises the visibility of the Engineering Technology program, and potentially strengthens relationships with donors and sponsors.

This paper provides an in-depth analysis of the program's structure, logistical framework, and the pedagogical foundations underpinning its design. Additionally, it presents the outcomes of the first two cohorts, emphasizing the program's impact on student learning and its broader institutional benefits.

I. Introduction

The Bachelor of Science in Engineering Technology (BSET) program was established at the regional campuses of The Ohio State University to address the growing demand for skilled professionals in manufacturing engineering technology in the region. Launched in Autumn 2020 at three of the university's four regional campuses, the program expanded to Ohio State Newark in Autumn 2023. As the first four-year engineering degree offered exclusively at the university's regional campuses, it is unavailable at the main campus, making it unique among engineering technology programs nationwide. This innovative structure is designed to meet the workforce needs of industries located near the regional campuses while being fully integrated into the university's College of Engineering.

The program aligns with broader trends in manufacturing, where automation and high-value production activities have driven growth and increased productivity. Automation has reshaped manufacturing roles, requiring advanced skill sets to perform production tasks. These high-skill jobs offer competitive pay, excellent benefits, and technologically advanced work environments. The rise of complex manufacturing processes has created a significant demand for talent with specialized and complementary skills [1]. The Ohio State University created this program with the goal of equipping students with the expertise needed to secure these well-paying jobs while meeting manufacturers' needs for skilled engineers who enhance productivity and competitiveness.

BSET graduates are well-prepared for diverse careers in manufacturing, product design, testing, construction, technical services, and sales. Some may also pursue opportunities in engineering entrepreneurship, facilities management, or operations management. By offering a four-year degree exclusively at regional campuses, the program addresses local industry needs while equipping students with a solid foundation in both analytical and interpersonal skills. This preparation enables them to advance into managerial and leadership roles, contributing to innovation and growth within the manufacturing sector.

All BSET courses are designed using the backward design process [2],[3], which begins by identifying specific, student-centered goals and objectives before developing other course elements. Courses are coordinated across all regional campuses to ensure consistent content and experiential learning. A key objective of every course is to connect the material with real-world applications. This is especially critical in the introductory course, where students new to the institution explore their academic and career options. To enhance first-year student motivation and retention, the Industry Mentorship Program was introduced. Through this program, students are paired with industry professionals who provide guidance, share insights, and help bridge the gap between classroom learning and practical application.

Bridging the gap between academic learning and industry practices has been widely recognized as critical for preparing students to meet the demands of today's rapidly evolving workforce. Numerous studies emphasize the importance of integrating real-world applications into academic curricula to address the disconnect between theoretical knowledge and practical skills. While traditional academic settings often prioritize foundational theories, these alone may not provide the practical context required for effective problem-solving in professional environments [4].

Research highlights that incorporating industry practices into educational experiences enables students to develop a deeper understanding of industry expectations, acquire relevant competencies, and gain confidence in their ability to transition from the classroom to the workplace [5]. Exposure to industry-relevant tools, methodologies, and terminologies ensures that students are not only prepared to meet current workforce demands but are also adaptable to future changes in the job market [6].

Moreover, aligning academic learning with industry practices significantly enhances students' employability. Graduates with both theoretical knowledge and hands-on experience are more likely to make immediate and meaningful contributions in their roles, which is highly valued by employers [7]. This alignment also benefits educational institutions by fostering stronger partnerships with industry stakeholders, driving curriculum innovation, and ensuring programs remain relevant to market needs [8].

This paper examines the design, implementation, and outcomes of a mentorship program aimed at bridging the gap between academic learning and industry practices. Beyond enhancing student learning, the program cultivates strong industry-academia collaborations, raises the visibility of the Engineering Technology program, and may play a role in strengthening relationships with potential donors and sponsors. The purpose of this paper is to provide a comprehensive analysis of the program's structure and logistical framework, highlighting the pedagogical principles that guide its design. Additionally, the paper explores the outcomes of the first two cohorts, emphasizing the program's impact on student learning, as well as the broader institutional benefits, including increased industry partnerships and enhanced curricular alignment with market demands.

II. Theoretical Framework

Kolb's Experiential Learning Theory (ELT) [9] offers a robust framework for mentoring programs in emerging Engineering Technology curricula, effectively bridging academic concepts with industry practices. As explained by Akella [10], the ELT model emphasizes a need for learner involvement in all educational activities and addresses the concept of how experience makes learning meaningful. The theory's cyclical process—comprising concrete experience, reflective observation, abstract conceptualization, and active experimentation—aligns seamlessly with the hands-on nature of engineering education. Industry professionals, serving as mentors, provide real-world experiences that allow students to engage directly with engineering challenges [11]. Through these interactions, students reflect on their experiences, connect theoretical knowledge to practical applications, and experiment with problem-solving approaches under professional guidance.

The mentoring program positions students for both academic and professional success, reinforcing the value of experiential learning as a cornerstone of their educational experience. By navigating real-world engineering problems, students build confidence and bridge the gap between academic preparation and industry demands. This experiential approach ensures that students are active participants in their learning journey, developing the skills and mindset needed to thrive in a dynamic field.

In addition to Kolb's ELT, Vygotsky's Social Constructivism theory [12] also informs our mentoring approach. The social component of the mentor-mentee relationship can significantly enhance the educational experience by emphasizing the importance of social interactions and cultural context in learning. As described by Sabani [13], Vygotsky's theory posits that cognitive development is deeply rooted in social interactions, where learners construct knowledge through collaborative dialogues with more knowledgeable individuals. In the context of a mentoring program, industry professionals serve as these "more knowledgeable others," guiding students through complex engineering concepts and practices. This mentorship aligns with Vygotsky's concept of the Zone of Proximal Development (ZPD) [14], which represents the gap between what a learner can achieve independently and what they can accomplish with guidance. By operating within this zone, mentors can scaffold students' learning experiences, enabling them to tackle challenges that would be beyond their solitary capabilities.

Vygotsky emphasized the role of language and culture as fundamental tools for cognitive development. Through regular interactions with industry mentors, students are exposed to the professional language, norms, and cultural nuances of the engineering field. This immersion facilitates the internalization of professional standards and practices, bridging the gap between academic learning and real-world application. Such social interactions not only enhance technical skills but also promote critical thinking and problem-solving abilities, as students learn to approach engineering challenges from multiple perspectives. By embedding Vygotsky's principles into the mentoring framework, the program fosters a collaborative learning environment where knowledge is co-constructed, preparing students to become competent and culturally aware engineering professionals.

Our mentoring program uses Kolb's ELT and Vygotsky's Social Constructivism to enhance student learning. Kolb's ELT focuses on learning through experience, reflection, and practice, aligning with the hands-on nature of engineering education. Industry mentors provide practical experiences that help students connect theory to real-world applications. Vygotsky's theory highlights the importance of social interactions and cultural context, where mentors act as guides to help students solve challenges within their ZPD. Together, these frameworks combine practical learning with collaboration, preparing students for success in both academics and the engineering field.

III. Program Design and Implementation

A. Objectives of the course and the mentorship program

The Industry Mentorship Program is a key component of the introductory Engineering Technology course offered every fall semester at the regional campuses of The Ohio State University. All first-year students interested in pursuing the BSET program are enrolled in the course. The course is open to all students, including those interested in engineering but undecided about which field to pursue. As the first course students encounter in their academic journey, this exploratory class is designed to help them reflect on their interests, capabilities, and aspirations while deciding if a career in engineering technology aligns with their goals.

For many students, this course serves as their initial exposure to the field, particularly for those who may lack prior knowledge or role models to guide them in selecting a college major. The course objectives, listed in Table 1, reflect an integrated approach to student development, focusing on industry engagement, career preparation, professional resources, teamwork, and communication skills.

Table 1. Course Objectives in Engineering Technology Introductory Course

Course Objectives	
1. Industry Engagement	○ Provide students with insights into roles in industry and the skills required to excel in those roles. ○ Enhance their understanding of common industry terminology relevant to their chosen trade, helping them communicate effectively within professional settings.
2. Career Preparation	○ Help students recognize the qualities, skills, and abilities that employers value in job candidates. ○ Support students in developing a preliminary roadmap outlining steps for continued educational and career advancement.
3. Professional Organizations and Resources	○ Guide students in locating and utilizing resources that provide valuable information for professional development and networking opportunities.
4. Teamwork	○ Encourage students to develop self-awareness of their leadership abilities through self-assessment and constructive peer feedback. ○ Promote collaboration by engaging students in group activities that help develop essential interpersonal and teamwork skills.
5. Professional Communication	○ Assist students in developing and demonstrating communication skills needed to convey technical topics clearly and effectively to diverse audiences, preparing them for professional presentations and workplace interactions.

These objectives are fully aligned with the Industry Mentorship Program. Through meaningful interactions with experienced industry mentors, students are given opportunities to explore career possibilities, understand professional expectations, and develop skills that align with both academic and industry standards.

B. Structure and logistics of the program

The mentorship program was initially established at other regional campuses in 2020 and expanded to this regional campus in 2023. What sets this campus apart is the significantly larger number of students and mentors involved in the program. While other campuses typically require only one or two mentors per cohort due to smaller student populations, the scale of participation at this institution is much greater.

The first cohort at this campus included forty-four students and eleven industry mentors, while the second cohort comprised thirty-nine students and nine mentors. This larger scale adds a layer of complexity to the program's logistics, requiring more coordination to ensure meaningful interactions and effective mentorship for all participants.

Program logistics involve several tasks that the course faculty and Program Coordinator must complete to ensure a successful experience for the students. These tasks include the following:

1. *Identifying and Recruiting Ideal Mentors*
   With the goals of the mentoring initiative in mind, we leveraged existing professional networks to recruit engineers who embody key characteristics essential for successful mentorship. Ideal mentors are:
   - Local practicing engineers,
   - Professionals with technical expertise aligned with the students' areas of interest,
   - Strong and engaging communicators, and
   - Willing to donate their time to support student development.

   To potential mentors, we emphasize the structure and value of the program, highlighting its carefully planned activities as an efficient and meaningful investment of their time and energy. A minimum commitment of four contact hours during the fall semester is requested, including participation in three informal student meetings and attendance at the students' final presentations. The proposed schedule, outlined in Table 2, is shared with mentors to ensure transparency and alignment of expectations.

   Table 2. Mentorship Program Schedule

Meeting Duration: 1 hour	Schedule	Topics for Discussion
Meeting 1	End of September or First week of October	Mentor and Company Background
Meeting 2	Third or last week of October	Technology, Skills, and Challenges
Meeting 3	Second week of November	Professional Development
Final Presentations	End of the semester- First week in December	Students Presentations

   Outreach efforts take place during the summer months, where faculty actively engage with potential mentors, touring their companies to build rapport and better understand their professional environments. Once an engineer agrees to mentor a group of students, a formal mentorship agreement is completed and signed, ensuring a mutual commitment to the program's objectives and the students' success.

2. *Forming student groups*
   The process of forming student groups and assigning mentors is facilitated using CATME (Comprehensive Assessment of Team Member Effectiveness) [15], a web-based tool designed to support group work by creating balanced and effective teams. CATME considers factors such as students' technical skills, prior experience, and preferred working styles to ensure diverse yet cohesive teams. Groups are capped at a maximum of four members to maintain manageability and encourage active participation from all members.

After group formation, each team is assigned a mentor, and the industry-mentor program is introduced as their project for the semester. Each team will represent a different company and share their learning about the company at the end of the semester. Students receive a detailed project description, along with a suggested timeline for their meetings with mentors. They are responsible for initiating contact and scheduling virtual meetings with their assigned mentors. While optional, a tour of the mentor's company may be arranged based on the mentor's availability, providing students with additional insight into real-world work environments.

To maximize the value of each interaction, student group meetings are structured around suggested topics and guided by a list of questions provided at the beginning of the program. These questions serve as conversation starters, helping students navigate discussions while encouraging them to add questions based on their personal interests and curiosity. Table 3 shows examples of questions students can use as conversation starters.

Table 3. Examples of Conversation Starters

Meeting	Topics	Sample Questions
Meeting 1	Mentor and Company Background	· What is the overarching vision and scope of this company? · Who owns the organization? · Where is its headquarters located? · How does the facility where your mentor works align with and contribute to the overall structure of the company?
Meeting 2	Technology, Skills, and Challenges	· What technology is used in 3-5 key areas of the facility? · What skills are essential for working with the technology you have described? · How do individuals typically acquire these skills? · Which skills are the most challenging to develop? · What business or technical challenges is the company currently facing? · What types of solutions could effectively address these challenges if they were available?
Meeting 3	Professional Development	· Looking ahead 5-20 years, what revolutionary technological skills and solutions do you think could have a significant impact? · How do you feel you have personally developed over your career? · What were the key initiatives you took to achieve this development? · What are the key things you think you should do for your future development? · Is there anything you wish you had done but didn't, that you would change if given the chance? · What advice would you give us for our personal development?

After each meeting, students are required to write a report summarizing key takeaways and reflecting on the experience. At the end of the semester, the groups compile a final report and deliver a presentation showcasing their project outcomes and what they learned through the mentorship program. This structured approach ensures that students not only gain industry-relevant insights but also develop communication, teamwork, and reporting skills essential for their future careers.

IV. Results

Students participated in a final presentation where they shared their work, and all mentors were invited to attend. The feedback from students highlighted several key points. Many expressed that the experience was highly valuable, with one student noting, "*It was a great experience. I had the opportunity to see a complete production line for the first time.*" Others emphasized the importance of meeting industry professionals, with one commenting, "*It was great meeting with an industry professional.*" Several students also expressed a desire for similar opportunities in higher-level courses, indicating a desire for continued engagement with industry professionals.

While the overall feedback was positive, some students encountered challenges during the process. Scheduling meetings proved to be difficult due to conflicting schedules, with one student mentioning, "*It was difficult to have a common time to schedule the meetings.*" Additionally, other students noted that not all team members were equally involved in the project, which presented another challenge.

Mentor participation in the program showed strong support, with eleven industry professionals volunteering in the first year and nine in the second year. A total of nine different companies, ranging from startups to international corporations, participated in the program, contributing to a diverse array of experiences for the students. A survey was administered to mentors, although it should be noted that only a third of the mentors responded, limiting the representativeness of the results. The feedback collected is displayed below.

Table 4. Mentor Survey Results

Survey Question	Strongly Agree/Agree	Neutral	Disagree/ SD
My experience as a mentor was positive.	100%	0%	0%
I believe I helped students gain a better understanding of their field.	100%	0%	0%
Serving as an industrial mentor has been a good investment of my time.	67%	33%	0%
I would like to continue to serve as an industry mentor in future years.	100%	0%	0%
Both my company and I are likely to benefit from my role as an industry mentor.	33%	67%	0%
I recommend this institution continue the industry-mentor program in future years.	100%	0%	0%

The comments received primarily concerned logistics and student preparedness:

- It would be good to know the objectives for each of the three meetings. The objective for the first meeting was clear (introduce myself and my company), but I had to improvise on subsequent meetings to provide them with what I think they needed.
- My group was well prepared and led the majority of conversations that we had. The only improvement would have been a little more timely responses when trying to coordinate visits.

While there were challenges related to scheduling and preparedness, the feedback received highlights the value of the program. Addressing these issues will help enhance future experiences, ensuring that both students and mentors continue to benefit from meaningful, productive engagements. The positive impact of the program demonstrates its potential for growth and success in fostering stronger industry-academic partnerships.

V. Challenges and Lessons Learned

Based on feedback from both students and mentors, several adjustments will be made to enhance the program in future iterations. The overall response to the program was overwhelmingly positive, with students appreciating the opportunity to engage with industry professionals and gain real-world experience. However, there were a few areas identified for improvement.

One key challenge that emerged was scheduling conflicts for meetings, which several students noted made it difficult to coordinate effectively. To address this, future iterations of the program will include more structured scheduling and perhaps a digital tool to streamline meeting coordination, ensuring that both students and mentors have aligned availability. This will help mitigate the difficulties related to finding common times, which several students mentioned.

Another point of feedback from both students and mentors was the need for clearer objectives for each meeting. One mentor expressed that while the initial meeting's objective was clear, subsequent meetings required more improvisation to meet the students' needs. To address this, the program will implement a more structured framework for the three meetings with defined objectives for each. This will help both students and mentors prepare more effectively and ensure that each session is focused and productive. This adjustment will improve preparedness on both sides and prevent last-minute improvisation.

Additionally, although most students actively contributed to the project, some reported uneven levels of participation among team members. This could be improved by setting clearer expectations for student participation at the outset of the program, along with mechanisms for tracking engagement and addressing any issues in real time.

Mentors also expressed a desire for more timely communication from students, particularly when coordinating visits. Moving forward, students will be encouraged to prioritize prompt communication and follow through on logistical matters to ensure smooth coordination with mentors.

Despite these challenges, the overall response from both students and mentors indicates strong support for the program. Mentors have found the experience rewarding, with 100% reporting that they believe they helped students gain a better understanding of their field and would recommend the program continue in future years. Several mentors expressed a need for more defined expectations and better student preparedness, which will be a priority in upcoming program revisions.

Proactively addressing these logistical and preparedness concerns will strengthen the program's ability to deliver impactful, high-quality engagement for both students and mentors. The positive impact of the industry-mentor program demonstrates its potential for growth and solidifies its importance in bridging the gap between academia and industry, creating a stronger foundation for future collaborations.

VI. Conclusion and Future Directions

In conclusion, the industry-mentor program has been highly valuable for both students and mentors. Students gained real-world experience, strengthened their understanding of engineering, and made important industry connections. Mentors reported satisfaction with their involvement, and most expressed a desire to continue in future years. However, challenges with scheduling and unclear meeting objectives were identified, offering insights for improvement.

To address these issues, the program will implement a more structured scheduling process and clearer meeting objectives. These adjustments will enhance coordination, communication, and engagement for both students and mentors.

Looking forward, the program aims to expand mentor participation, further diversify industries represented, and continue refining the structure based on feedback. By addressing current challenges, the program can continue to bridge the gap between academia and industry, providing valuable experiences for all involved.

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