

# Learning and Thoughts of How Industrial Internship Can Inspire New Generation Talents

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## Abstract

This paper reviews an inspiration model for young talents in MLOptic corp.'s industrial education outreach program.

With proper mindset training to focus on the end delivery through milestone-based essential necessities allocation, proactively self-learning and logistic thinking capabilities can be greatly magnified independent of education level and age, significantly boosts the courage to explore unknown technical or non-technical challenges, promotes confidence and desires to self-grow into a technical expert. The logic to get things done naturally plants the seed of leadership and grows efficiently through more teamwork practice. An example was described to support this model.

**Keywords:** Internships, high school internship,

## 1. INTRODUCTION

This paper discusses the importance of internship programs in motivating young generations to pursue their future careers in engineering fields, and includes personal remarks and reflections of a high school student on her internship at an optics company. While the word “internship” does not trace far back in time, the act of students working for the experience can be traced back to the 11th century; now, fast forward to the 21st century, when internships have become a staple activity for many colleges, and even high school, students – and for good reasons. Specifically, exposure to professional engineering workplaces has been scientifically shown to be an effective venue of training for technical and soft skills, a positive predictor of plans for engineering, and a better understanding of real-world engineering. This paper uses the Industrial Education Outreach Program at MLOptic Corp. as an example to show the importance of providing student interns a personalized and motivating experience. This paper also includes the experience of a recent high school intern of MLOptic Corp.'s Industrial Education Outreach Program, where they detail their thoughts and personal impacts from their internship.

## 2. The Value of industrial Internships

According to the National Association of Colleges and Employers, an internship is “a form of experiential learning that integrates knowledge and theory learned in the classroom with practical application and skills development in a professional setting.” [1]. Fundamentally different from a classroom setting, internships introduce students to a whole new way of learning and working – one that reflects what is found in the real world. Foremost, by providing students with an opportunity to work in a real-world environment, internships teach students important soft skills that are crucial for their future success. For example, several research studies concluded that internship experiences often resulted in improved communication, problem-solving skills, time management, critical thinking skills, independence ability, creativity, and perseverance, among others [2, 3]. Secondly, internships are an ideal place for students to gain technical skills as well. Not only do industrial internships have the ideal resources (e.g., equipment, environment, and personnel) to best teach students technical skills, but pedagogical research has shown students to be more motivated to learn during internships as they could engage in activities or lessons that they were likely to encounter in the real world [4]. Finally, internships could greatly contribute to producing a sufficient workforce for the industry, as studies have shown a consistent trend of students who had engineering internships to be more likely to pursue a career and stay in the

engineering industry compared to students who did not [5]. According to a report published by the Center for the Advancement of Engineering Education, “exposure to professional engineering workplaces and projects is a positive predictor of plans for engineering work, and a negative predictor of plans for non-engineering work after graduation.” [6]. Of course, the impacts of internships not only differ for each individual but also for specific internship programs, but the general trend of internship benefits is quite clear.

### **3. MLOptic Corp.’s Industrial Education Outreach Program**

MLOptic Corp. is a company specializing in precision optical, mechanical, electrical, software, and systems integration. For over twenty years, MLOptic Corp. has helped customers around the globe with the application and creation of successful products in the medical, life science, semiconductor, aerospace, and other emerging markets. Through their Industrial Education Outreach Program, MLOptic Corp. also places great attention on fostering interest in the engineering field among younger generations. Starting in 2021, to expand and formalize MLOptic Corp.’s educational outreach activities, the Industrial Education Outreach Program aims to promote STEM careers for students of all backgrounds and education levels by providing them a personalized internship that fosters new knowledge, soft and technical skills, and opportunities for meaningful activities.

Foremost, this program provides a variety of internship tracks, ranging from finance to management to engineering. Within each general track, the internship experience is personalized towards the student in regards to specific activities, the technical skills they learn, and projects they will take part in. At the beginning of each internship, a mentor or multiple mentors are assigned to the intern according to their field of interest and skills. Based on their initial assessment, mentors will start the student’s internship with individual or group lessons on various topics that will expand the intern’s knowledge in their field of interest and better prepare them for their internship. By doing so, the intern will not only have a strong foundation to lean upon for future projects but will also have enough time to transition into the new environment (e.g., meet members of the company) to better learn soft skills. During the first couple of projects, the intern will hold comparably minor roles and be walked through step-by-step as much as possible. Example projects include conducting mini or portions of hands-on experiments, reading papers, or shadowing an employee. Then, if the intern has shown success in their project(s), they will be assigned projects that require them to conduct outside research and apply new knowledge, pushing them to expand their capabilities. Depending on the student’s internship track, such projects can range from writing code, conducting/designing more complex experiments, working/organizing data, and working on bigger team projects. Afterward, if time and/or resources allow, interns will be given the opportunity to conduct projects (largely) independently. In addition, to improve the student’s chance of success, each step of the project (or at least the first steps – e.g., initial ideas and proposal) require approval by the intern’s mentors. Furthermore, MLOptics Corp. encourages the interns to put what they have done into patent applications or research papers, which not only gives students added motivation but also, if the project is successful, a major boost in confidence. Throughout this process, clear, personalized goals and workplace support are put in place to facilitate and motivate the intern’s work, which has been proven to work well through exploratory factor analysis [7].

In addition to a personalized internship, the education outreach program also strives to help interns develop soft skills like time management, networking, and independence. For example, to improve the student’s time management and prioritization skills, mentors are directed to start an intern out with one project at a time and then start assigning multiple projects at the same time. This way, interns are pushed to create time manageable schedules, develop prioritizing skills, and also learn/voice their limits in work capacity. In addition, mentors at MLOptic Corp. are encouraged to use personal work connections to help the intern network with individuals outside and inside of the company. Finally, intern mentors are advised to increase the amount of freedom that interns enjoy at a reasonable pace; for example, interns are

encouraged to start scheduling meetings on their own, creating their own schedules, and conducting independent research, all of which help to develop important, real-world soft skills.

While MLOptic Corp.'s Industrial Education Outreach Program is relatively new with room to improve, the past few years have seen multiple successful internships which have taught MLOptic Corp. the benefits of hosting interns. Apart from bringing in new faces to the community, the fresh mindsets of students who are eager to think outside the box also bring benefits. The difference between the lines of thinking that interns hold compared to those of experienced engineers has proven to be highly beneficial in answering both simple and complex problems that could have significant impacts. In addition, mentors have repeatedly confirmed that explaining concepts to interns has strengthened their own understandings, improving the mentor's own efficiency and abilities, which will, in turn, benefit the company. Finally, all of the interns who have passed through MLOptic Corp.'s Industrial Education Outreach Program are currently pursuing a career in engineering, with the majority ending as full-time employees at MLOptic Corp. Thus, knowing the mutual benefits that internships provide, MLOptic Corp.'s Industrial Education Outreach Program plans to expand in the following years and encourages other organizations to do the same.

#### **4. Experiences of an Intern**

*The following was written by Teresa Zhang, a research intern at MLOptic Corp.*

*Teresa Zhang is an incoming senior in high school and has been a research intern at MLOptic Corp. for the past two summers. As an intern, Teresa contributed to two granted U.S. Patents and a research paper, received the 2022 SPIE Optics and Photonics Education Scholarship, and received the 2022 SWENext Global Innovator Award. As a high school student, Teresa is a two-times Math Prize for Girls Invitee (an honor for the top 300 female competitors of the American Mathematics Competition), a two-times American Invitational Mathematics Examination (AIME) qualifier, a nationally qualifying debater, a 2022 National Just Poetry Winner, and received a perfect score on her SAT.*

I am an incoming senior at Emma Willard School in Troy, NY. When I first entered MLOptic Corp. as an intern in 2021, my knowledge of optics can be reasonably described as nonexistent. As a result, I walked into my internship with low expectations and high worries, but to my surprise, my beginner level was completely expected by my mentors. During the first week, my mentors gave me lessons on the fundamentals of optics, basic engineering knowledge, coding lessons, and even laboratory training. In addition, I was tasked to write lesson summaries or answer questions afterward to solidify my understanding. As expected, the pace at which these lessons went was extremely accelerated compared to the typical high school course, but my mentors did their best to personalize the lessons, slowing down in areas I had the most trouble with and cutting down on materials I would not immediately need.

Following this "orientation period," I was assigned my first project to work on, which consisted of laboratory work under the guidance of my mentors. I was given a detailed run-through of how to conduct the necessary laboratory work, which was to take pictures of an impure camera lens while varying different freedoms of the light source (e.g., pupil size, color); this laboratory work was the perfect transition from the classroom-like environment I was in during the "orientation-period" to the company's hands-on work environment. In addition, while the work was not complicated, it pushed me to communicate with others and also taught me lessons about being precise with every move, as even the slightest mistake could have ripple-like effects.

From there, my mentors started to use my academic strengths to determine the tasks I was to conduct next. Given my experience as a competitive mathematics student and love for geometry, my first major project revolved around creating a geometric model for a calibration device that would optimize accuracy and minimize size. In addition, knowing my background in writing and interest in technical writing, my mentors often gave me research papers to analyze and tasked

me with writing descriptions of projects I was working on. Finally, observing that I enjoyed hands-on work, my mentors started assigning me more lab work where I could learn by physically conducting experiments. Being given such personalized tasks that allowed me to use prior knowledge and activities I enjoy made the internship more productive and interesting, propelling me to make the most out of this internship.

While it is cliché to talk about the importance of “finding your passion,” this internship not only helped me actually find my passion but also showed me how doing something I am truly interested and curious about can fuel my productivity and ability. Before coming into this internship, a career in electrical engineering – much less optics – had not been something I was certain or particularly excited about. What became the “epiphany” for me to pursue a career in electrical engineering was my first major project that used geometric modeling to solve an engineering problem. After having a couple of weeks’ worth of exposure to engineering, I was in awe of how extensive engineering really is, and through this project, I got to personally see how engineering required the proficiency and usage of mathematics, physics, writing, and designing skills. Thus, as an avid learner who wanted a career that would use various knowledge, electrical engineering suddenly became an attractive option. I realized how “not boring” a career in electrical engineering would be. Growing up, a career in engineering seemed mundane and sedentary. However, being able to go through the process and see how I could turn an idea into reality made me realize the endless opportunities and excitement of an engineering career; and through the projects I participated in from this internship, I realized the endless opportunities and paths an engineering career would have.

Once I had it clear that I would be pursuing a career in electrical engineering and received the opportunity to continue interning at MLOptic Corp., I saw my own ability and accomplishments in the field of electrical engineering grow, a feat I treasure as a high schooler. Through other projects I took part in, I am now a contributor on two granted U.S. patents, second author of a published research paper, and received the 2022 SPIE Optics and Photonics Education Scholarship. In addition, my experience as an intern also helped me get accepted into the 2022 RISE Internship Program at Boston University, one of the nation’s most prestigious STEM summer programs. If I had been told I would be where I am now a year ago, I would not have believed it. The internship program at MLOptic Corp. helped me discover my potential as a high school student and helped me maximize my ability as best as possible, all while making sure I still enjoyed the process.

Finally, I would like to highlight two aspects of MLOptic Corp.’s internship program that I find particularly special. Foremost, the program goes beyond the traditional academic training and teaches interns important soft skills, often without them even knowing. For instance, when I first started being tasked with actual projects, my mentors started with giving me one at a time and slowly giving me multiple at a time. While I was unaware that it was intentional at the time, I later realized that this was done to strengthen my multi-tasking, time management, and prioritizing abilities, which it had been successful in. By also slowly giving me more freedom in creating my own schedules, scheduling meetings to ask questions, and making sure my progress was reasonable, they created a comfortable environment for me to transition away from a student’s lifestyle and into an independent lifestyle that I would find success in.

Another aspect of MLOptic Corp.’s internship program that I find special is how they will use their own connections to help interns gain opportunities that they would have never been able to do by themselves. For example, when I showed interest in learning more about how electrical engineering could be used in the medical industry, my mentor scheduled a meeting for me with an optics professor who had done years of research in the medical area and sent me related papers beforehand so I could have a fruitful conversation (which I did). In addition, having been in the industry for many years, my mentors at MLOptic Corp. informed me of opportunities like the SPIE Optics and Photonics Education Scholarship and gave feedback on any application materials needed.

While it might be too extreme for me to call my internship a life changer, it definitely was close, helping me foster my interest in electrical engineering and providing me with exciting opportunities. I highly encourage any high school or college student to actively seek internship opportunities in various engineering-oriented companies, no matter where you are in your academic journey, there will most definitely be things to learn and opportunities to try.

## 5. Conclusion

For students, internships are valuable opportunities to expand their knowledge and experience; not only do they get to learn technical and soft skills under the guidance of professionals but also get to participate in projects that could lead to exciting results. As studies have shown, such experiences bring various benefits to students and the industry in general; for example, students who have gone through engineering internships not only improve their time management and critical thinking skills but also are more likely to pursue an engineering career. Realizing the benefits of internships, MLOptic Corp.'s Industrial Education Outreach Program strives to provide personalized internships with goals that motivate students; and positive results are supported by Teresa's experience as she describes her internship at MLOptic Corp. as meaningful and productive.

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