Analyzing Approaches to Engineering Education

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Engineering curriculums aim to adequately prepare students for future jobs and develop their ability to adapt to ever-changing technological environments. Institutions of higher education mainly do this through teaching their students problem-solving skills. However, this is not the only possible approach to engineering education. Some other perspectives maintain that engineering education should be holistic to broaden engineers' solution space, should teach corporate software and methodologies to attract more job recruiters, or should be more individualized since all people learn differently. My experiences attending the University of Virginia's (UVA) engineering school advocate for an engineering curriculum centered around teaching corporate software and methodologies. My first internship with SES Satellites opened my eyes to the corporate world. SES uses software (Bamboo, Docker, Ansible, etc.) and methodologies (Agile) that are commonplace among software companies. Despite this popularity, these software and methodologies were unfamiliar to me and created a steep learning curve. It felt like UVA's curriculum for engineers majoring in computer science left me unprepared for the workforce. Moreover, I later received a post-graduation, full-time offer from Leidos (which I accepted) mainly due to my experience using Ansible – a software that I learned to use at SES, not at UVA. Through these experiences, I gained a new and surprising perspective of engineering education: maybe (software) engineers should learn software and practices in use by a majority of companies instead of less relevant, fundamental (programming) knowledge. My new and old perspectives of engineering education are given context by the ideas expressed in David Hess and Benjamin Sovacool's "Sociotechnical Matters".

In Hess and Sovacool's work, the authors define technoscientific "imaginaries" as a framework that examines the collective assumptions and representations of sociotechnical order

(Hess & Sovacool, 2020). Here, the sociotechnical order is the education of engineers and the collective assumptions are the differing views of what engineers should learn in school. Stakeholders have built up claims for these views about what material is best for an engineer to learn. In order to objectively judge the topics around which engineering curriculums should be based, we must dissect each approach to education, observe potential biases, and evaluate the true advantages and disadvantages of each education strategy.

Many of these ideological battles on engineering education are fought in the realm of higher education. Stakeholders including universities/colleges, the Accreditation Board for Engineering and Technology (ABET), corporations, and students each have their own perspective on engineering education. It seems that universities feel responsible for engineers' long-term success such as helping their students obtain job security for 20-30 years post-graduation. In reality, students' current situations may call for different goals, like immediate monetary relief post-graduation. In such cases, students may not be able to make long-term-minded decisions such as working unpaid internships or attending a graduate school. Instead, students may have to make short-term-minded decisions such as getting a lower-paying, provisional job straight out of college. This practical decision-making process challenges the goals set forth by universities for their students: is it best for universities to prepare their students for long-term career goals or to cater to their students' immediate needs? In order to answer this question, we must analyze the true responsibilities of institutions of higher education for their engineers.

Benefits and Shortcomings of Different Approaches to Engineering Education

There are many approaches to engineering education. The 4 major views being considered here are engineering curriculums that focus on problem-solving skills, a holistic education, company-specific skills, and individually-tailored learning. Each approach has strong and weak points. In examining the pros and cons of each perspective, it is useful to consider their long-term and short-term effects. The first approach we'll discuss centers around problem-solving skills. A literature review written by scholars at Universiti Teknologi Malaysia argues that technology is ever-changing, making it less critical for engineers to learn present-day technology and more critical for engineers to learn skills that will enable them to learn emerging technologies in the future. In this way, engineering students will be more prepared in the long-term when facing new and unforeseen challenges. Moreover, the article's authors argue that human errors are a major source of problems in the workplace. The authors believe that these mistakes can be reduced and easier detected by engineers that have well-developed problem-solving skills (Subramaniam et al., 2020). While beneficial in the long-term, this approach is more disadvantageous in the short-term since it is less concerned with teaching present-day technology. Thus, students must learn corporate software and skills on their own when entering the workforce. This can make it more difficult to obtain a job post-graduation and do well in that position once employed.

Similar to curriculums centered around developing engineers' problem-solving skills, the perspective advocating for engineers to receive a holistic education is also long-term oriented. Anders Buch, a professor at Aalborg University in Copenhagen, Denmark, asserts that "to solve real problems in substantive practices, […] narrow engineering skills and knowledge are not sufficient," (Buch, 2016, p. 2). Thus, some solutions can only be found by considering factors outside of those learned in a non-holistic engineering education. Moreover, all real-world problems are affected by external elements. If an engineering curriculum teaches students to factor these elements into their solutions for their future problems, it will make their solutions more realistically plausible (Buch, 2016). This approach to engineering education supports engineers' long-term success since it aims to improve the way engineers think about and address their future problems (even if those problems arise 20-30 years post-graduation). However, this approach falls short in the short-term. Corporations are not always concerned with their employees' long-term performances. Amazon, Google, and Mosaic are companies that employ engineers but have some of the highest recorded employee turnover rates (PayScale, 2021). These firms are less concerned with their workers' long-term capabilities and more concerned with their starting knowledge. This introduces yet another perspective.

Contrasting from the previous perspectives discussed, another approach to engineering education aims to satisfy short-term goals like teaching engineers commonly-used company software and methodologies. Engineers with this knowledge are more useful to companies in the short-term since there is no learning curve upon beginning employment. This attracts companies like Google since Google contracts more temporary workers than full-time workers, numbering "121,000 temps and contractors [and] 102,000 full-time employees" (Wakabayashi, 2019, para. 4). Moreover, learning company-specific software and methodologies does not limit engineers' immediate post-graduation job opportunities since these software and methodologies are so widely used. Docker, Ansible, and Agile are examples of software or methodologies that are pervasive among software companies. According to the DZone Container Trend Report, 2019 saw 20% of global organizations run container services like Docker and Kubernetes (a similar software) and 2023 expects this percentage to rise to 70% (DZone, 2021). Likewise, over 16,349 companies started using Ansible in 2021 and many other companies use software similar to

Ansible like Chef and Perforce (Slintel LLC, 2022). Furthermore, the 15th Annual State of Agile Report documented that 94% of the companies surveyed practice Agile (Digital.ai, 2021). Despite these advantages, the benefits of this approach to engineering education diminish in the long term. There is no guarantee that the software and methodologies prevalent today will continue to be used by most companies for 10-20 years post-graduation. Students of this curriculum will have to use the new tools that emerge in the workforce, but their education may not have developed their problem-solving skills well enough to be able to learn how to use those tools.

The last perspective centralizes engineering education around a student's needs. The job-related needs of students vary from person to person and can be influenced by their (and their family's) current situation, especially financially. A study conducted for the Journal of Applied Psychology found that students from lower social classes cannot get well-paying jobs as easily as students from higher social classes (DeOrtentiis et al., 2021). Since students from lower social classes may need to financially support themselves and/or their family, it may be beneficial to focus their education around immediate job preparation rather than around long-term goals like problem-solving skills or getting a holistic education. Moreover, student-tailored curriculums are not limited to students from lower social classes. All people are unique, which means that different learning strategies suit some people better than others. Furthermore, students are at different stages in their career process while in college: some students have clear career aspirations and others are undecided. Why should a student who has forever dreamt of being an astronaut take a religion class? However, this mindset is sometimes considered myopic. If, after joining the workforce, this interstellar dreamer suddenly realized they have no interest in going to space but gained no experience in other fields from their education, they might be stuck working an unfavorable career for 10-20 years post-graduation. Thus, these students may not be as prepared in the long term.

Stakeholder Views on Engineering Education

We observe above that each approach to engineering education has benefits and drawbacks. We want to determine which learning strategy maximizes the gains and minimizes the costs for engineers. Stakeholders have built up various claims for which curriculum suits engineers best. Their claims are integrated into engineering curriculums in several ways. One way is through donations. An NPR article "Ayn Rand Studies on Campus, Courtesy of BB&T" explains how BB&T Bank (now known as Truist Financial) donated money to 25 colleges for multiple years in order to start programs at those colleges that center around teaching Ayn Rand's books and economic philosophy (Davis, 2008). Another way through which stakeholders influence engineering education is through sponsored events like coding competitions. For example, the annual HooHacks competition at the University of Virginia (where I am currently enrolled) is often sponsored by corporations like Leidos, Northrop Grumman, Capital One, Palantir, Google, Microsoft, and more (HooHacks, 2022). Such events help shape the experiences of engineering students, thus illustrating more ways that these corporations influence engineering students' learning. Alumni can also shape engineering students' learning in the forms of guest speaking during classes, advising current students, connecting students to networks of different people, and more.

However, we will mainly focus on how stakeholders influence engineering curriculums through ABET. ABET creates the rulebook by which all college engineering curriculums must abide. ABET's engineering curriculum requirements support various perspectives of engineering education. Some necessary student outcomes listed by ABET include students developing abilities to "produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social environmental, and economic factors" and "recognize ethical and professional responsibilities [and] consider the impact of engineering solutions in global, economic, environmental, and societal contexts" (ABET, 2021, para. 21). Returning to Anders Buch's work, we can see that these goals align well with the objectives of holistic engineering curriculums, which consider issues like "sustainability, global warming, health, and security" and involve learning an overlap of "cultural-discursive, material-economic, and social-political" material (Buch, 2016, pp. 2 & 4). By contrast, Erin Cech argues that ABET's goals center more around the ideology of depoliticization rather than holistic learning. Cech describes depoliticization as "the belief that engineering is a purely 'technical' space in which engineers design technological objects and system–a space devoid of socio-cultural complexities," (or in other words, devoid of holistic learning) (Cech & Sherick, 2015, pp. 205-206). She believes that the previously mentioned ABET goals seemingly in support of holistic learning "demarcat[e the socio-cultural] contexts as separate outcomes," and thereby help "reproduce, rather than undermine, depoliticization," (Cech & Sherick, 2015, p. 209). These views are supported by ABET student outcomes focusing on completely technical goals, like gaining "an ability to identify, formulate, and solve complex engineering problems" and "an ability to acquire and apply new knowledge as needed using appropriate learning strategies" (ABET, 2021, para. 21). Thus, we can see that ABET gives some criteria more importance in its engineering curriculum requirements than other criteria.

Many of ABET's current engineering curriculum requirements are due to the goals of institutions of higher education. Universities strive to improve their students' long-term outlooks since this is one way that universities can earn more revenue from their benefactors. The National Center for Education Statistics reported that in the 2018-2019 school year, postsecondary institutions received most of their funding from fees like student tuition, from the government, and from miscellaneous sources like gifts and sales (National Center for Education Statistics, 2021). The amount of funding universities receive from these sources is affected by the long-term success of college students because of the overall academic reputation it creates for the school. For example, students are more willing to pay higher tuition costs to attend a school if they know that they can make that money back and do well in their job(s) down the road. Moreover, the government funds universities so long as they continue to successfully prepare students for the current and future corporate world. Finally, gifts such as alumni donations are only possible if the alumni are financially stable in the long-term. These factors coalesce to create objectives that overall favor the long-term well-being of college students, such as in the form of well-developed problem-solving skills and holistic mindsets. With this in mind, we can again consider the true responsibilities of institutions of higher education. University funding is one possible explanation for why colleges are focusing on skills that help students in the long-term rather than skills they might actually need, such as those that provide some form of immediate relief. Teaching long-term assets like problem-solving and holistic skills might be useful for inflating students' post-graduation job salaries, thus improving colleges' reputations in the eyes of their benefactors. Comparatively, teaching short-term assets might not seem as essential to university patrons, potentially causing them to pull their funding.

Corporations are another stakeholder that attempts to influence ABET with its own preferences for engineering education. It can be useful for companies to hire graduating engineers that already have experience with the tools used by that company. A study conducted by Oxford Economics found that without this prior knowledge, it takes about 29 weeks for a new hire in the IT or technology industry to reach the productivity level that is expected of a veteran worker in that role (Oxford Economics, 2014). This loss of productivity costs the company money. Over all industries, the 2021 Training Industry report concluded that on average, companies spend $1,071 for each new employee's training (Freifeld, 2021). Moreover, it is not uncommon for engineering companies to hire workers for specific tasks or temporary work. As mentioned earlier, companies like Google, Amazon and Mosaic hire engineers but have high employee turnover rates. It makes more sense for these companies to hire new employees with prior experience using the tools involved in the project for which they are being contracted to start and/or finish. These considerations lead many companies to lean toward supporting engineering curriculums that teach their students company-specific skills, software, and methodologies.

However, not all engineering firms share this short-term mindset. Companies like G3 Technologies – a software firm where I was recently employed – focus on their employee retention rates. The Vice President of Engineering at G3, Andrew Park, believes that engineers only improve their technical skills by staying with one company and that the longest-serving G3 employees are his best (Hawes & Park, 2021). G3 Technologies centers its training programs around teaching new employees how to write efficient, reusable code. Thus, G3 is much more concerned about the long-term capabilities of its workers, like their fundamental and problem-solving knowledge, than their knowledge of G3 software and methodologies upon first coming into the job (Hawes & Park, 2021). Thus, not all companies share the same perspective as those with high employee turnover rates such as Google, Amazon, and Mosaic.

Proponents of student individuality would argue that individually-tailored curriculums are best for engineers' learning. In "The Trouble with Passion", Erin Cech discusses the negotiation between varying student goals upon which engineering curriculums are built. Cech argues that students have been encouraged and/or shamed into believing their desires for a STEM degree are appropriate. The author contends that past goals for students have centered around obtaining job security and economic stability. Cech also states that newer sentiments, echoed by well-respected figures like Steve Jobs and reiterated by cultural expectations for individualism and self-fulfillment, have contrastingly pushed for the pursuance of student passions when job searching (Cech, 2021). Through this discussion, we see the influence that stakeholder pressure has on engineering students. When contemplating the true responsibilities of institutions of higher education for their students, we must examine whether the goals being fulfilled are actually objectives of the students rather than of the stakeholders coercing them. For example, we cannot assert that all students want to obtain job security or pursue their passions since their desires were susceptible to stakeholders' external pressures. Cech believes that there needs to be a dialogue between what students want and what students need. She feels that we do not know the nuance of students' ambitions and needs because no one has actually asked the students (Cech, 2021). Individually-tailored curriculums offer a solution to this dilemma as, unlike the other curriculum options we have discussed, they do not assume what students need and allow students to decide for themselves what they need.

Engineering Curriculums that Disrupt Traditional Approaches to Engineering Education

These stakeholders hold differing views for which approach to engineering education best suit engineers, regardless of whether or not their beliefs are based on personal gains. ABET determined that students’ long-term preparedness – in the form of developing problem-solving skills and including holistic material – should be central to engineering curriculums. The committee also conducted studies that evaluated the effectiveness of their academical guidelines. ABET found that its policy to include more courses that teach professional and ethical responsibility in engineering curriculums had a positive effect. According to the report, “a statistically significant relationship [was discovered] between the amount of required applicable curriculum content [relating to ethics] and student performance on the professional ethics section of a nationally administered, engineering-specific examination,” (Barry & Ohland, 2011, p. 386). Thus, the curriculum requirements ABET added in hopes of making engineering education more holistic and centralized around problem-solving are making a noticeable difference (Barry & Ohland, 2011). Despite ABET’s curriculum requirements, several colleges have implemented unique learning strategies that disrupt the traditional approaches to engineering education. It is valuable to see how other kinds of curriculums can work for engineering students even when not using conventional methods.

Case Study: Northeastern University

Northeastern University centralizes engineers’ learning around corporations with its cooperative education (co-op) program. Northeastern’s co-op program is “an educational model that provides students with opportunities to alternate periods of academic study and periods of full-time employment related to their academic majors and interests” (Northeastern University, 2021, para. 2). In other words, students take an internship for 6 months during the academic year instead of going to classes. This gives students hands-on experience within their field and teaches them valuable information about the workforce. Through this program, students can learn the inner workings of a company such as company practices and tools and how to use those tools.

Herman Schneider was the originator of co-operative education. After working in a diverse span of fields such as architecture, railroad construction, and civil engineering, Schneider "saw engineering curricula of that time as merely an extension of traditional liberal arts education [and that] for technical students the classroom and outside would could be related" (Marston, 1961, p. 98). Schneider met opposition due to the perceived impracticality of his plan but eventually implemented a co-operative engineering education at the University of Cincinnati. In 1909, Frank Palmer Speare implemented a co-operative plan at a second institution known as the Polytechnic School of the Boston YMCA Evening Institute (which eventually became Northeastern University) (Barbeau, 1972). The program's initial implementation did not lead to an academic degree and students alternated between periods of classroom study and employment in Boston industrial companies on a weekly basis. The first year of this program had 4 participating companies and 8 students. The program had a large appeal in Boston, and by 1913, it had 14 participating companies, 107 students, and curricula for several more engineering fields (like civil and mechanical). The YMCA institute, which was at this point known as Northeastern College (and would be renamed Northeastern University in 1922), was authorized to grant degrees for its cooperative program in its Co-Operative School of Engineering in 1920. This engineering school was renamed Northeastern's College of Engineering in 1936 (Marston, 1961).

As time went on, Northeastern began to offer more co-op programs such as for industrial electrical, and chemical engineering. The engineering school continued to expand its roster of cooperating companies and enrolled students. Additionally, more schools were added to

Northeastern, such as the Colleges of Business Administration, Liberal Arts, and Education. These schools were built on the premise of the cooperative education plan, similar to the College of Engineering (Marston, 1961). Thus, corporations were able to gain a position in Northeastern schools' curriculums from the very beginning. Many of Northeastern's first students chose Northeastern for its unique cooperative education experience and were required by the university to participate in it (the university would also decide the employer for whom they would work), which is what allowed corporations to become such a critical stakeholder. Due to the importance of corporations in Northeastern's academic curriculums, Northeastern began to foster relationships with corporations by visiting employer sites to ensure co-op programs are running smoothly and by hosting dinner conferences with employers to discuss how the co-op programs could be improved (Marston, 1961). Thus, these corporations had significant influence over Northeastern's academic curriculums and resulted in adjustments to Northeastern's co-op programs like an increase in the length of the alternating work/study periods (alteration periods were eventually increased from 1 week to 10 weeks).

But why did employers ultimately agree to participate in Northeastern's co-op programs? During the Great Depression, employer sentiments about cooperative education was not favorable. Companies did not have enough jobs available to employ students and when they did, employees resented their student colleagues for taking the jobs of men trying to earn enough money to support their families (Marston, 1961). Eventually, sentiments changed when the job market boomed after World War II. Corporations needed extra manpower to keep up with rapid business and industry expansion, resulting in a greater willingness to hire students in co-op programs. This also resulted in students being assigned work that was more meaningful to the company than the work students had been assigned previously (Marston, 1961).

As with all engineering schools, ABET is another critical stakeholder in Northeastern's engineering curriculum. A study was conducted to see how well the co-op programs at the University of Cincinnati and Northeastern adhere to ABET's engineering curriculum goals–if the co-op programs detracted from ABET's goals, then the schools' curriculums would need to be changed. A list of ABET's learning objectives for engineering students was assembled and students from Cincinnati and Northeastern were asked how well they thought they had learned each objective in their curriculums. At both universities, the study found that the co-op program actually strengthens the students' abilities in the learning areas set out by ABET. The report concluded that "[c]o-op learning goals have always mirrored the full range of ABET Criterion Three, including the technical and 'soft' skill attributes," and that "[t]he impact of cooperative education on the development of [ABET's learning objectives] within all engineering disciplines [is] realized across disciplines," (Canale et al., 2000, p. 5.145.24). Moreover, the authors even suggest that colleges without a co-op program implement one since they were shown to be so beneficial.

Today, Northeastern lets students choose their own employers and does not require but still strongly encourages its students to participate in its co-op programs, and many do. In 2021, the undergraduate engineering school at Northeastern placed 2,660 of its nearly 4,000 students in co-ops (Northeastern University, 2021). Furthermore, 96% of Northeastern's 2016 graduating class participated in at least one co-op, and 78% participated in 2 or more co-ops (Northeastern University, 2022). This unique program is helpful for engineering students' job search and careers. Northeastern reports that 90% of its graduating students are employed full time or enrolled in graduate school within 9 months of graduation. Furthermore, 50% of co-op participants receive return offers from their co-op employers (Northeastern University, 2013).

Case Study: Purdue University

Purdue University was founded in 1869 with the purposes of teaching agriculture and the mechanic arts (Purdue University, 2022). Like Northeastern, Purdue started as an engineering school. Unlike Northeastern, Purdue's beginnings were based on engineering education strategies that are more traditional. By the time Purdue decided to tailor its engineering curriculums to the needs of its students, the university had already established several majors within the engineering school such as mechanical, civil, chemical, electrical, etc. and multiple other colleges within the university including the schools of agriculture, architecture, medicine, science, and a graduate school, and more (Purdue University, 2022).

Among its traditional programs, Purdue's College of Engineering offers students the ability to major in common engineering fields, including mechanical, civil, electrical, chemical, computer, biomedical, and more. The school's uniqueness stems from its untraditional School of Engineering Education, which centralizes around the students' needs by allowing them to personalize their curriculums according to their interests. The School of Engineering Education "envisions a more inclusive socially connected and scholarly engineering education" and does this by "[r]e-imagining engineering education" (Purdue University, 2022, para. 1-2). The first part of this unique education is the First-Year Engineering program. This program gives students a generalized engineering experience so the students can determine which engineering field they should pursue in their career. Moreover, the School of Engineering Education consists of 2 divisions: multidisciplinary engineering and interdisciplinary engineering. The multidisciplinary engineering path is designed for future engineers with career goals that cannot be accommodated within one of the traditional engineering fields. The interdisciplinary engineering path is designed for students that want an engineering education but do not plan to practice engineering in their future career. These programs provide engineering students with an atypical college experience that allows them to receive an education consisting of individually-tailored learning.

How did Purdue University shift away from its traditional engineering education strategies to the disruptive engineering education approach it uses today? Purdue alumnus and the university's fourth Department of Freshman Engineering head, Richard Grace, wrote a memoir detailing how this shift occurred. Originally, Purdue assigned the classes that each student was required to take and there were no services through which students could receive counseling or guidance. Eventually, attitudes around the university shifted the focus of engineering curriculums more towards student interests. This was in part due to the advanced technology that was revealed during World War II since students had developed a desire to learn about engineering marvels like radar, sonar, bombsights, and the atom bomb (Grace, 2010). Engineering societies like the Engineers' Council for Professional Development (ECPD) and the American Society for Engineering Education (ASEE, formerly SPEE) began to look for changes that could be made to engineering curriculums. Thus, students started becoming more relevant and important stakeholders to Purdue's engineering curriculums. According to Grace, the new engineering curriculum emphasis was on "basic science, engineering science and engineering analysis, design and systems," (Grace, 2010, para. 30). Emerging from these new sentiments, ASEE Committee member and the then Dean of Engineering at Purdue, George Hawkins, created the Faculty Committee on Freshman Engineering in 1953 (Grace, 2010). This committee was focused on creating a new set of freshman year requirements and led to a new Department of Freshman Engineering at Purdue. The Department of Freshman Engineering sought to provide students with enough time to adjust to engineering so they can choose to pursue the branch of engineering that is best suited for them. It was the first program of its kind by any university in the nation (Purdue University, 2022). By 1956, freshman students were subject to new graduation requirements, consisting of more math, chemistry, and physics courses (Grace, 2010).

In 1969, Richard Grace founded the Division of Interdisciplinary Engineering Studies (IDE). This division was meant to “offer new nontraditional engineering majors to freshmen; a few engineering examples include acoustical, architectural, biomedical, environmental, engineering management, systems engineering, pre-med, pre-law, etc.,” (Grace, 2010, para. 39). These majors were very appealing to incoming freshmen and curricular reform soon followed in the other Schools of Engineering as well. The addition of this division further pushed students into a more critical stakeholder position for Purdue’s engineering curriculums, since it is completely based around student interests. Eventually, ABET came out with new engineering curriculum requirements in 1997. ABET was a similarly critical stakeholder of Purdue’s engineering curriculums since its accreditation standards were widely accepted and becoming ABET accredited would substantially benefit Purdue’s engineering school. In 2004, Purdue consequently merged the Department of Freshman Engineering, IDE program, and a new Multidisciplinary Engineering program (which also centers around the students’ needs and interests) into a new Department of Engineering Education (which was renamed the School of Engineering Education in 2008) (Purdue University, 2022). Thus, the restructuring of Purdue’s engineering curriculums demonstrates the influence that ABET has over Purdue’s engineering curriculums.

Since these early days in Purdue’s development, the university has continued to cultivate engineering curriculums that tailor to specific student needs and interests. For example, Purdue invested $750 million into an interdisciplinary research and learning complex called Discovery Park in 2001. This complex houses over 4,000 faculty and students (Purdue University, 2022).

Within this complex is the Flex Lab interdisciplinary research facility. Purdue invested $54 million to build this lab in 2017, further promoting students to pursue their interests through cross-disciplinary innovation (Purdue University, 2018).

Discussion

After examining all this data, you may still be uncertain about which learning strategies best suit engineers. Each approach has advantages and disadvantages, varying in long-term and short-term benefits. Stakeholders believe certain curriculums are better suited for engineers than others, but they also maintain biases that push them toward those beliefs. ABET, which acts as an executive repository for the claims of all stakeholders, devised its engineering curriculum guidelines around goals aimed to maximize engineering students' success in the long-term. But what is "success", really? The knee-jerk response is that success is akin to obtaining economic stability and job security. However, it is not the intention of all people to pursue these goals; an even more pervasive ambition is to be happy. Happiness does not always align perfectly with objectives like long-term economic stability and job security. Sometimes, individuals would rather accept a lower-paying job than a higher-paying job in order to pursue something that makes them happy. Similarly, one might choose not to relocate for a better-paying job in order to stay close to their family or friends. Money is not the only factor when people make career decisions so it is impossible to correlate the "success" of one's career only with their income. Once again, this challenges the true responsibilities of institutions of higher education, since they believe themselves responsible for students' success. Universities must decide if it is more important to give students what university officials think the students need or give students what they actually need.

After experiencing UVA's engineering curriculum and working an internship that was corporate-software-heavy from the start, I can see the benefits of each perspective. I understand the importance of developing problem-solving skills and honing an ability to consider external factors by enduring a holistic education. Moreover, I recognize that I have not had time yet to reap the long-term benefits of an engineering curriculum that is centered around problem-solving or is holistic. However, my internship with SES showed me how difficult it can be to start a corporate job without prior knowledge of company software. I felt fortunate to not be in a peculiar financial situation requiring me to join the workforce immediately after graduating. This sentiment made me feel like students should be able to choose to learn corporate software if they know their financial situation is going to be a problem in the short-term. More generally, this led me to support the view that engineering curriculums (specifically computer science engineering curriculums, since my expertise mostly lies in this field) should be individually-tailored to support students' needs, especially since they are responsible for paying their own tuition. This mindset similarly influenced my opinion on what institutions of higher education are truly responsible for when instructing their students: instead of focusing on their students' "success", universities should focus on giving students the education for which they paid. In other words, inform students about the different options of material from which they can choose to learn, in what ways each option will help their career moving forward, and from this information, let them decide what path they feel is best for them to take. This is a big decision for a student to make if they are not in a situation calling for individual curriculum tailoring. That is why I think traditional engineering curriculums that encompass ABET's goals should continue to be offered as a potential learning path and advertised as a general education, in that it works for the purposes of many rather than the purposes of individuals.

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