



## The Challenge of Preparing iGen Students for Engineering and Computer Science

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# The Challenge of Preparing iGen Students for Engineering and Computer Science

## Abstract

A recent suicide by an engineering student began the desire to better understand those undergraduates entering higher education today, the internet Generation (iGen) or GenZ. Many of today's professors find it hard to relate to pressures that have shaped the lives of iGen students. iGens grew up with smartphones and internet access but has the exposure been a positive influence? The literature today shows that iGens are not prepared for the challenges of adulthood or college life. Too much parental involvement has deprived students of the opportunity for life experiences. As a result, college counselors are seeing record numbers of students. Almost 50% of college students have reported some sort of mental illness with over a third of the students indicating that they have contemplated suicide. Who are iGens? What life skills and experiences do they bring with them to the university? More importantly, what is the role of the university, in particular our engineering and computer science programs, to prepare these students to become productive members of the workforce? Industry is already recognizing that current engineering and computer science graduates lack some of the basic skills needed for success in the workplace. Feedback from industrial advisory boards indicates that the current generation lacks skills such as work experience and face-to-face social interaction. How does the university help students overcome the challenges that arise from being part of the iGen culture from which they came? This paper will address some of these questions by defining iGen, providing relevant insights, and discussing the implications for engineering and computer science programs. Understanding these topics should help faculty become more aware of iGens and give context, hope, and direction as they interact with these students.

## Introduction

Last spring one of Baylor's top engineering students committed suicide. Everyone loved him and he appeared to have many friends. His death was a shock to the campus. Questions were asked trying to understand what led up to this unfortunate event. It became obvious that the faculty, especially the older faculty who were near retirement, did not fully understand the new generation of students entering the university.

The statistics concerning suicide rates among young adults are shocking. Today, suicide rates among teens and young adults have reached their highest point in nearly two decades. Approximately 1100 college students commit suicide each year, making it the second-leading cause of death among college students. Roughly 12% of college students report the occurrence of suicide ideation during their four years in school, with 2.6% percent reporting persistent suicide ideation [1]. Burnell reports on a recent study published in *Depression and Anxiety* that surveyed more than 67,000 college students from more than 100 institutions. The results showed that one in five students have had thoughts of suicide, with 9% making an attempt and nearly 20% reporting self-injury. Suicide rates for teenage girls ages 15-19 doubled from 2007 to 2015 while for boys in the same age group the rate rose 30%. These are shocking numbers which explains why suicide is the second leading cause of death for people ages 15-24 [2].

The increase in suicide rates is an indication there is a mental health crisis facing the university. The American College Health Association in their Spring 2018 report states that 63% of college students have had anxiety attacks the past year, 42% have felt so depressed they can't function, and 12% seriously considered suicide [3]. The Center for Collegiate Mental Health's 2018 Annual Report considered data contributed by 152 college and university counseling centers, describing 179,964 unique college students seeking mental health treatment, 3,723 clinicians, and over 1,384,712 appointments [4]. These numbers are disturbing.

A recent radio interview with Dr. Jim Marsh, Executive Director of the Baylor University Counseling Center, reported that the increase in student visits at Baylor over the 2017—2018 academic year was 70% and the following year saw a 50% increase as well [5]. With a student population of approximately 17,000, Baylor now sees almost 3,000 students a year in their counseling center or 17% of Baylor's enrollment. Baylor has a student mental health professional ratio of approximately 775 to 1 and, while a good ratio, it is not enough. California State University reports there is an increase in hopelessness, loneliness, sadness, depression, anxiety and suicidal thoughts over the past two years and that 16% of their students received some sort of psychological counseling or treatment over the past year. The University of California reports that in the last 10 years students seeking mental health services has increased 78%, nearly three times the enrollment growth over the same time period [6]. These are the students entering the university classrooms.

Much blame for the lack of preparation of iGens is given to the use of smartphones and access to the internet. Smartphones are always with them. iGens can have access to the internet at any time. Social media has shaped their expectations for life by their making constant comparisons with others. Technology devices, such as smartphones, also allow gaming, and coupled with headsets, can provide a virtual world into which someone can escape reality. While connections can be made with other people on the internet, it is no substitute for face-to-face conversations.

A Google search of "mental health crisis in the university" yielded 158,000,000 results. This indicates that there is some activity in addressing the mental health crisis in the universities however, there seems to be no coordinated effort to halt this rising epidemic. More studies are needed as to determine the severity of the mental health crisis. Faculty are in the best position to interact with students and must be ready to face these issues. If the university wants their graduates to be successful, then the university must be a place for helping iGens transition to adulthood, ready to face the challenges of the workplace and life.

### **Who are the iGens?**

This current generation is called the internet Generation or iGen, sometimes also referred to as GenZ. Dr. Jean Twenge is the author of the book *iGen: Why today's Super-Connected Kids are Growing Up Less Rebellious, More Tolerant, Less Happy-and Completely Unprepared for Adulthood* [7]. She defines iGen as people born between 1995 and 2012. This accounts for 74 million young Americans who are becoming the most important generation in the nation's history [8]. Twenge states that one in four is Hispanic and nearly one in 20 is multiracial. Non-Hispanic whites had occupied a slim 53 percent majority of this group in its earlier years; however, that percentage falls to under 50 percent beginning with iGens born as of late 2009 [7].

Thus, no one ethnic group is in the majority. What distinguishes iGens is they have always had access to the internet, smartphones, and social media. Mediakix characterizes iGens (GenZ) in this way [9]:

- Gen Z will be a 2.56 billion global population by 2020. By 2025 they will be 29% of the American population.
- 98% of Generation Z members own a smartphone.
- 85% of Gen Z learns about new products via social media.
- 10 hours of screen time: the amount of time nearly *half* of Gen Z spends on devices each day.
- 71% of this generation watches more than three hours of online video daily.
- 67% of Generation Z prefers seeing “real people” in ads.
- When Gen Z grows up, they’ll make up 40% of U.S. consumers.
- 50% of children are expected to be part of a minority ethnicity by 2020.
- 8 seconds = Gen Z’s attention span.
- 51% of this population uses ad-blocking software.
- A mere 9% of teens prefer Facebook over other social media platforms.

iGens seem to be the most connected, technologically capable generation but with this brings the pressures of growing up with technology. Having constant access to the internet can be overwhelming, leading to anxiety and stress. iGens are growing up not prepared to face life’s challenges. Most have had anxiety attacks or depression, labeling this generation the most prone to mental health issues. Without a strong foundation of life experiences during their teen years, they enter the university on their own. Familiar college life experiences like having a college roommate can be traumatic because many iGens had their own room growing up. Now at college they must wake themselves up, go to class on time, and schedule their activities, things their parents may have done for them at home. As a group iGens are less likely to have a driver’s license, many never have held a part time job, and they have less life experiences like dating. Thus, many iGens face life experiences for the first time in college which, combined with feelings of loneliness and insecurity, can lead to mental illness.

iGens depend on their phones. Their phone is their friend and on it they have virtual relationships. The phone also keeps them connected to Mom and Dad instead of broadening their life experiences, making decisions, and growing as a person. Failure and adversity have not been in the iGen vocabulary. The term “Helicopter Parents” is very well known and often used to describe well-meaning parents who are overinvolved in their children’s lives . Many iGens grew up with what is being referred to as “Lawnmower Parents,” also sometimes called “Snowplow or Steam Roller Parents,” who are willing to mow down anything that might get in the way of their children. Having never “failed,” iGens are entering college unprepared for what they will experience which puts them at risk.

## **Disturbing Trends**

Dr. Jean Twenge discusses 10 topics in her book, each a chapter, that show disturbing trends concerning this generation. She compares iGens to previous generations using four databases: Monitoring the Future, The Youth Risk Behavior Surveillance System, The American Freshman

Survey, and the General Social Survey. Her research relates longitudinal studies that have been conducted for decades. When something is observed in the data that is very different, she investigates the circumstances that were occurring during that time. Twenge's observations from the chapters in her book are summarized below [7]:

- 1) Growing Up More Slowly – Fewer iGens go out on dates. Fewer iGens have sex. Many do not have a driver's license. Fewer iGens have part-time jobs. Alcohol consumption has dropped. This generation is doing fewer “bad” things and are happy to be under the care of their parents. They are growing up more slowly.
- 2) Social Media/Internet Dependence - On average, high school seniors spend 2 1/4 hours per day texting, 2 hours on the internet, 1 1/2 hours playing games, and 1/2 hour on video chat. These figures are the same for wealthy or poor teens. Social media use (or video gaming for boys) has exploded. They do not go out (to movies or other events) or watch TV. They typically do not read books or newspapers.
- 3) Virtual Relationships – iGens socialize less in person, preferring to do this virtually. 44% of high school seniors report spending 10 hours or more per week online. The research shows that teens who spend more time on screen activities are more likely to be unhappy.
- 4) Mental Health/Insecurity - iGens are less happy. They feel more anxiety and depression which can lead to suicide.
- 5) Being Irreligious – Less students identify with a religious group. Only 28% of high school seniors attend church. If religion conflicts with science, iGens must choose sides, with science usually being the default.
- 6) Isolation/Safety and Community – There is a strong desire for safety in all areas of life. They smoke less, drink less, and drive less. iGens want emotional safety, especially on campus. They think it is a good idea to help others but are less likely to do so.
- 7) Income Insecurity/Work and Work Ethic – iGens just want to get a job and earn money. They are less receptive to starting their own business. iGens are not as concerned about fashion trends but would rather wear safe clothes.
- 8) Sex, Marriage, and Children – They have less sex and less partners. They are concerned about safety (sexually transmitted diseases and pregnancy). Pornography and “hook up” sex are also part of this culture. They seem afraid of having real relationships.
- 9) Diversity/Inclusivity – LGBTQ is fine. Accepting transgender is fine. As for gender roles, they reject the stay-at-home-mom concept. Race is generally not an issue as well.
- 10) Politics – iGens see themselves as independents. They are more likely to have libertarian views. They are less likely to trust the government, get involved, or even follow the news.

## **Engineering and iGens**

While much has been published regarding iGens in general regarding their preparation and attitude toward college, there is very little available that isolates those students choosing to study engineering or computer science.

Industry tells us new hire engineering students lack the social and essential skills (sometimes referred to as soft skills) to be successful [10]. Technology has become an impediment to developing interpersonal relationships and people skills. iGens would rather communicate

through technology than in person, a frustration to industry managers, especially when the communication concerns conflict. A KRONOS Workforce Institute study discovered that 40% of iGens say their high school or college prepared them for the workplace however, they admit that they were never taught how to negotiate, speak publicly, network, or resolve conflicts [11]. The term “fragility” is used to describe new hires, when we should be describing our graduates as resilient [12, 13, 14]. Dr. Peter Gray states the decline in student resilience among college students is a serious problem [13]. A sample of employers identified the following trends concerning iGens at work:

*The employers in the sample nearly all claimed, usually emphatically, that they had witnessed reduced resilience and an increased sense of entitlement in young employees. They talked about new employees’ inability to accept or respond appropriately to constructive criticism, and their beliefs that they should almost immediately get promotions and higher pay, even if they were doing the bare minimum of what the job required. If they got poor evaluations, according to the employers, they complained that the employers had not made the expectations sufficiently clear [14].*

What is certain is that iGens have definite characteristics and both the university and industry seem to be adapting to their presence. Industry is assuming that the current generation of new hires will be iGens and is preparing for the challenges that these new hires bring to the workplace. They recognize that in the workplace iGens [15]:

- are independent.
- like to know what is going on.
- like to be challenged.
- want to move quickly.
- are under lots of pressure to succeed.

Industry is investing heavily in training opportunities to help iGens transition to the workplace.

The university is also changing to accommodate this incoming class of students. Felder and Brent, in their book *Teaching and Learning STEM*, offer many suggestions on how to teach STEM topics [16]. Moore et al. in their article “Engineering Education for Generation Z” trace the history of engineering education and then discuss the changes that must occur in education to accommodate this new generation of students [17]. More research is needed to determine if STEM university students are typical iGens or not. The observations of the authors thus far suggest that many STEM university students reflect the iGen trends and are no different.

### **Helping iGen Prepare for the Workplace and Life**

As students enter the university, there is an implied requirement to help students mature from where they are to where they need to be upon graduation. Van Treuren and Jordan addressed the role of the university in the formation of student maturity [18]. The university is a community where personal development occurs. A function of the university is embodied in the phrase “in loco parentis.” Legally, it means “in place of a parent” and refers to the obligation of a person or organization to take on some of the functions and responsibilities of a parent. At any university,

students should receive a quality education while, at the same time, achieve an acceptable level of maturity. Each student enters the university at a different level of maturity. However, as the students entered the university with different skill levels, they will leave with different levels of maturity. Universities must prepare students for graduation and to be able to adapt to the challenges they will face.

What can the university do to help them reduce stress and anxiety in their lives? Dr. Twenge talks about understanding iGens being the first step towards helping them. There are many ideas being proposed to help iGens become more functional and prepare them for the future. The authors have discussed some of these issues in previous papers [18, 19].

As one seeks to prepare iGen students for the engineering workplace, there is need to consider several aspects of this preparation. This includes the following:

- Essential skills
- Real life experiences
- Unplugging from technology
- Work mindset
- Character development
- Faculty Development
- Educational Recommendations for Improvement
- Social skills

### **Essential Skills**

The Association of American Colleges and Universities reported that employers think essential skills, like oral and written communication, and working with others in teams, need improvement [20]. Companies have developed lists of essential skills that are important to the workplace. These include topics such as communication, creativity, adaptability, collaboration (teamwork), and leadership, with the communication and collaboration high on the list [21, 22]. To be successful requires more than just knowledge about a technical, engineering topic. If one graduates from an ABET accredited program, technical competency is assumed. Today's engineer must have an arsenal of essential skills to be successful in the workplace. Industry feedback indicates students are not prepared.

On the list of needed essential skills is the ability to communicate. Having excellent communication skills will positively impact a person's life. Written communication is important and, for engineers, technical writing is especially important. It must be clear and concise. The authors have observed most students today write like they talk or text. Student e-mail is another good example showing where these skills are deficient. How can we help iGens develop soft skills in writing? Give opportunities in your classes to write and revise. Practice makes perfect.

Oral communication is also important. It is not just being able to give a PowerPoint presentation. Faculty need to place iGens in situations where they need to talk to their classmates. Use classroom techniques like think-pair-share. Knowing how to talk to others leads to satisfying relationships. Working on teams is also important for industry. On a team, oral communication

is so important. Team projects are in every curriculum. At Baylor, a survey showed most students approach team projects by dividing the tasks and then putting the project together just in time, involving little interaction. On a team, you have to work with other people, usually in person, to get something done. Developing personal relationships in the work environment makes work more enjoyable and the chances for success in the team project more likely.

iGens must learn how to be a good team player, encouraging and empowering others to help them improve their skills. Use techniques in team projects such, as the Jigsaw, requiring team interaction to hold each other accountable. Knowing how to initiate conversations in the team context will lead to more satisfying relationships than can be achieved with a phone or the internet. This skill can be helpful in initiating conversations and relationships outside the work environment as well.

As faculty, university programs and courses must have opportunities for iGens to practice these skills. Failure to develop essential skills will lead to anxiety and possibly depression. Developing essential skills leads to success in the workplace and in life. Being able to communicate, especially on teams, will build real relationships and address feelings of loneliness and isolation. Without these relationships, it is difficult to experience real life.

### **Real Life Experiences**

Worldview is defined by the authors as a set of beliefs about fundamental aspects of reality that ground and influence all one's perceiving, thinking, knowing, and doing. It is a particular philosophy of life or conception of the world. Life experiences form an individual's worldview and this worldview provides the foundation upon which we react to the world around us. Life can bring devastating experiences. How does one face this adversity? Having faced adversity before and, for some, relying on faith, leads to a resilience drawing from those previous experiences which can make a difference in how one responds to these current challenges. Seemiller and Grace, in their book *Generation Z Goes to College*, confirm iGens have fewer life experiences [23]. iGens would rather be home with their parents, would rather be on the internet, rather connect with people on social media than in person, do not have part time jobs, do not have drivers' licenses, and do not date. In general, they are growing up more slowly, in part because they do not have life experiences. Dr. Twenge states this current generation of students is entering college with the emotional maturity of a 15-year-old [7]. Without this foundation, when they get to college, iGens are experiencing some of these things for the first time. This leads to pressure and anxiety.

So, what university life experiences can help iGens prepare for the workplace and life? iGens need to be encouraged to develop life experiences but in a safe, controlled environment. One such opportunity at the university might be student organizations. At the university there are many student organizations to join. These organizations often have outreach activities off campus. Baylor has a group, Engineers with a Mission, which helps bring electricity and water to rural areas in Haiti and Central America. Baylor's Basic Utility Vehicle (BUV) group builds functional utility vehicles for rural people in Uganda. These are life changing experiences which help our students focus, not on themselves, but on others. One can also find these types of outreach activities on almost any campus. It is not necessary to go to a developing world country



to participate in these of activities. At Baylor, being a religiously affiliated university, students are encouraged to be involved in a local church where there are also opportunities for life experiences serving others. These life experiences build life skills and provide a foundation for a worldview which will influence students for the rest of their life. With a life of service comes joy and the satisfaction with helping others. Helping others will also help iGen fill the loneliness which seems to be present with this current generation. Without real life experiences students will not have the courage or confidence to consider unplugging from their technology.

## **Unplugging from Technology**

Dr. Twenge states iGen students are some of the smartest and most connected people on the planet [7]. They have never known life without the internet and the smartphone. iGens have grown up with immediate access to sites such as YouTube and Netflix. Instantly one can watch whatever they want. The average teenager spends 7 hours and 22 minutes a day on screens for entertainment, a significant portion of their waking hours [24]. This does not include screen time for school. A study in Europe had 153 business students agree to go without their phones for one day [25]. These students reported that they did not know what to do with the “extra” time at breakfast and riding public transportation. They felt anxiety. Cell phones had become an “addiction.” While there is some debate among medical and mental health professionals about whether excessive cell phone use is truly an addiction, research is showing that your brain receives a shot of a feel-good chemical called dopamine when you have an enjoyable experience with your cell phone [26]. This brings you back for more and before you know it you are addicted.

Unplugging from technology might be what ultimately matters in the life of iGens. iGen students spend a lot of time on smartphones and social media. Their life revolves around likes and what others think. They also draw idealistic opinions from viewing other people’s lives. This leads to comparison and feelings of inadequacy, which will eventually lead to mental illness, such as depression. While unplugging totally from technology would be unrealistic, how do you break the technology addiction? At the university, one should create technology free “safe zones”. Technology has its place, however there are definite times when it is not appropriate to have a smartphone presence. Classrooms generally are not the place for smart phones. Eating meals with family, friends, or faculty should be technology free. Perhaps the university could arrange field trips or have social activities that are designated technology free, thereby requiring people to interact. What other safe spaces could one offer to students? Whatever these safe spaces are, if one asks iGens to occasionally surrender their technology, they must be given alternatives that are equally as attractive, like a face-to-face conversation, cooking a gourmet meal, playing a board game, going outside, doodling, or just doing nothing. Perhaps a reward system might be in order to help iGens develop healthy behaviors. Students need to unplug from their technology and plug into real life.

## **Work Mindset**

There is a difference of opinion and perspective between the world one lives in and the higher values we might hold when one considers the term “work”. The term “work” is given a deeper definition at Baylor University, synonymous with the word “vocation.” Vocation carries the

implicit definition of the work in which a person is employed, but explicitly includes the notion that the work a person does is something for which they have a strong desire or summons to do. At Christian universities, this second definition is more suited, and should be used as it applies to Baylor students. The hope for these students is that they find what they were designed to do by God, since this design is usually something to which they are innately drawn or called. In doing what one is designed to do, the implication is that one will find great meaning and fulfillment in the work they do. This would be important in the life of iGens. For example, Baylor has a relatively new option within its generic engineering program called Humanitarian Engineering [48]. This program is about undertaking engineering for the benefit of the poor people of the world. The entire motivation for this program is based upon an approach to virtue and character which assumes that those who are more privileged have an obligation to use learned engineering skills to help others. Again, the focus on others builds relationships and addresses isolation and loneliness.

### **Character Development**

Many essential skills follow from what might be called character formation. Being trustworthy means people can depend on you, especially in the team environment. Having honesty and integrity means telling the truth even when it might not put you in a favorable light. Being openminded makes you approachable and people will want to have conversations without you because you are not criticizing but are accepting. Above all, take responsibility for your actions, do not blame your past environment or social media for your problems. Character development should be aspirations for all engineering programs to help iGens.

### **Faculty Development**

Faculty training concerning the mental health crisis is beginning on university campuses [27, 28]. Training programs like Question, Persuade, Refer should be part of this training [29]. Any new faculty orientation should include information on the mental health crisis facing students. Some faculty are not interested in participating as they do not feel that they are qualified to become involved with students who have mental health problems. They say to leave this to the professionals. Professors, however, are in the best position to support students and to evaluate their performance in the classroom. Abrupt changes in student performance can signal deeper issues which would then require assistance. Just recognizing these behaviors could help save a life.

At Baylor's School of Engineering and Computer Science, there are monthly faculty seminars/workshops which can fill a number of purposes. This past fall these seminars/workshops were used to help educate the faculty on issues facing iGens. They were held during the lunch to provide an opportunity for higher attendance. Typically, between 40% and 50% of the engineering faculty attend. The two topics addressed this past semester were Inclusion and Insecurity.

For the first gathering on Inclusion, the Dean for Student Development at Baylor as well as the Baylor University Chaplain attended. There was a lively discussion on the university climate for LGBTQ, gender, and racial issues. The discussion touched on the focus of each of these student groups and how the faculty should handle situations regarding these students in their classes.

The second gathering looked at Insecurity and featured the Executive Director of Baylor Counseling and the Senior Case Manager for Student Life. Both guests were informative about the caseloads facing the counseling center and how faculty can help by recognizing students at risk, referring them to the counseling center.

### **Educational Recommendations for Improvement**

Although engineering education has evolved over time to address changing societal needs as well as evolving generational characteristics of students [17, 22], with the rapid pace of technological changes, it is clear that the background and experiences of iGen students will continue to inform reformation in engineering education. iGen students come to a university with a different set of experiences and skills than past generations, and as a result, educational pedagogy should adapt to ensure that foundational understanding is attained.

According to Moore, Jones, and Frazier [17], there are five pedagogical areas that can be integrated into the classroom with relative ease:

1. Integrate Active, Collaborative, and Problem-Based Learning – ACL and PBL techniques are well known and have been shown to assist in developing creativity and engagement in students [30].
2. Help Students Extract Answers from an Ocean of Information – While most iGen students are adept at finding answers to surface questions through technology, many are poor at finding information that is harder to find. Students should be encouraged to seek the assistance of technical librarians in finding credible, peer-reviewed research.
3. Assess Often and Provide Feedback – iGen students are characterized by the fact that much of their educational assessment has been conducted through standardized tests. Faculty should consider the effectiveness of their assessment techniques and provide ongoing feedback to students in a timely manner.
4. Engage Creativity – It has been the case in the past that many engineering problems presented in a classroom have had a single solution, most problems that students will encounter in industry are far more complex, requiring employees to be able to generate ideas to challenges. Faculty should be encouraged to expose students with scenarios that require the natural creative abilities of their students.
5. Help Students Make Connections – Faculty need to help students understand how their current coursework applies to and builds on not only their current understanding, but also their future coursework and their future careers.

This resonates with what is found in Dr. Twenge's book. According to Dr. Twenge, iGens are more pessimistic and less confident than previous generations [7]. They are more willing to work hard in class and not question the grades. They are hesitant to talk in class because they do not want to say something wrong. Having grown up with the internet, they are used to finding information themselves. They want professors to keep class interesting, keeping videos, etc. to three minutes maximum. This is important when planning class time for iGens. Typical iGens do not read books but would rather read online. These students are less likely to be entrepreneurs. They are less confident and will need more guidance for tasks. They want a safe environment in the classroom and at any future workplace. iGens are more likely to include their parents in major decisions such as future work. The primary means of communication is texting

for iGens but this can be replaced by such platforms as Instagram and Snapchat. Dr. Twenge states that iGens are scared, maybe even frightened of the future. They are the physically safest generation to come along but they are also the most mentally fragile.

Seemiller and Grace have some insights into the learning environment for iGens [23]. These students like being able to learn alone and at their own pace. iGens use the internet a lot and spend time learning on sites such as You-Tube, Wikipedia, and Kahn Academy. They state that 90% of online content has been created in the last 2 years so this trend will be growing. iGens consider education as a means towards their eventual career. Practical experience is important and 79% of iGens think educational programs should integrate internships. While iGens' IQ is increasing, the creativity quotient of this generation has been decreasing since 1990. In a survey, 84% of parents and 79% of teachers think there is not enough time allocated in schools to develop creativity. If students do not get exposed to creativity in elementary and high schools, then creativity will not be there for the university. Problem based learning might be one solution to increasing exposure to creativity. In the university classroom, iGens prefer to work alone until help is needed from other students or professors. Group work is needed to develop intrapersonal skills, however, most students approach group work by dividing the tasks. A definition of group work to iGens is everyone working separately on the same Google Doc. Group work must be redesigned and all members of a group should sign agreements on how the group will function.

Seemiller and Grace continue to discuss the campus environment and the learning environment. On campus, safety is important for iGens. They must be in a safe environment to travel on campus. Activities on campus must be inclusive and affirming. Ideally these students should live on campus which means campus housing should be affordable. In addition, these students need health food options at the dining facilities.

In the learning environment, Seemiller and Grace suggest that programs align with industry and use industry advisory boards to keep their programs up-to-date. Curriculums must include items reflecting a socially conscious awareness. Students should learn how to properly do research and find what is acceptable to obtain from the internet. For education, make learning a shared experience. Flipping classrooms is recommended as are setting milestones for major projects leading up to the final submission instead of just one submission. This helps reduce stress.

## **Social Skills**

Social skills are defined as the skills used to interact (communicate) with other people. These are the qualities that are often thought of as interpersonal skills used in direct personal contact with other people. This is both verbal and non-verbal communication [31]. Engineers are often stereotyped as lacking social skills. The need for social skills is a key factor for engineering students to develop interpersonal skills according to Lopes et al. [32]. This is especially true in the team environment. Lopes et al. have developed a program to promote interpersonal skills at their university called PROPDIP (Interpersonal Professional Development Program). They put their students in a series of experiences to give them opportunities for development. Included in these experiences is a strong encouragement to be involved with an internship. Assessment of results showed an improvement in interpersonal skills. While this is positive, Waters et al. showed that students perceive they have improved interpersonal skills over their four years in an

engineering program [33]. Improvement does not necessarily mean proficiency. In light of the Industrial Advisory Board feedback, there is still more room for additional improvement. Developing these social skills will result in [31]:

1. More and better relationships – people trust you and want to be around you
2. Better communication – being able to relate with people
3. Greater Efficiency – using time wisely for social interactions
4. Advancing Career Prospects – relating to people in the organization better
5. Increased Overall Happiness – getting along and understanding people

In engineering programs, it is desired to give students opportunities to exercise their social skills to gain confidence in these situations. This will prepare them to be ready for any circumstance in work or life.

## **Conclusion**

The world is changing rapidly and engineering programs need to adapt to prepare students to face these challenges. It is the shared responsibility of the university, the students, and Industrial Advisory Boards to anticipate the essential changes and then to implement these changes. There needs to be a strong foundation of skills that, if done correctly, will empower students to face any challenge that would lie ahead.

Universities need to also adapt to the changing nature of their students, the internet Generation. Universities need to prepare them to meet the skills needs of the future. While we need to change the pedagogy of our programs, this does not mean that we should lower the performance standards of what students need to know and be able to do. Universities also need to do this in a way that our iGen students understand and can appreciate.

Bill Damon, a professor at Stanford University and the Director of the Stanford Center on Adolescent Excellence, has expressed his views on what is needed in campus culture. He states:

“The future of any society depends upon the character and competence of its young. In order to develop character and competence, young people need guidance to provide them with direction and a sense of purpose. They need relationships that embody and communicate high standards. They need to experience activities that are challenging, inspiring, and educative. Many of the conditions for the development of character and competence in the young have deteriorated in recent years . . . young people often encounter inattention, low expectations, cynicism, or community conflict. . . . All of these conditions must be changed if we are to create a society where youngsters can attain their full potential [34].”

While ABET identifies criteria and outcomes that deal with technical competency and maturing students to an acceptable level of ability, it does not address the issues of mentally, physically, and emotionally preparing students for the workplace. Understanding the culture that iGens grew up in and the challenges they will face in the university prepares faculty to help these students make the transformation to the workplace and better cope with life. While some programs to

address mental health are done through the university, so much more could be accomplished as part of an engineering or computer science program.

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