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Preparing students for jobs of the future:

Closing the skills gap in engineering education

February 2021

Academic institutions are charged with training the next generation of engineering graduates—preparing students to excel in the jobs of today and fill the jobs of tomorrow. But what trends should academic institutions be aware of to provide students with the best value and opportunities? What's at risk if an institution doesn't incorporate Industry 4.0 technology and topics when preparing students for the jobs of the future?

Autodesk recently commissioned research from Automation Alley's Research and Development Division to better understand the supply and demand dynamics shaping two- and four-year mechanical engineering educational institutions. The result was a comprehensive 50+ page report, *Closing the Skills Gap in Engineering Education: A Multidimensional Perspective*. Here are the highlights.

I. KEY TRENDS AND TAKEAWAYS

- Industry 4.0 technology breakthroughs are outpacing academia's ability to change.

- Employability and employability skills are often inadequately taught or excluded from formal high school and college technical education, making it difficult to prepare students for jobs of the future.

- Students and employers are increasingly questioning the value of a traditional college degree.

Autodesk shapes the future of our industries with research, relationships, and collaboration among customers, educators, and policy makers.

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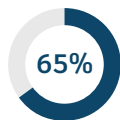
Academia and Industry: Training the next generation together >

II. HIGHLIGHTS FROM THE REPORT

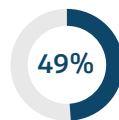# Preparing for jobs of the future

30%	65%	49%	80%
30% of the middle-skilled labor pool will be displaced by automation by 2030[i]	65% of children that entered elementary school in 2018 will work in jobs that haven't yet been invented[ii]	49% of current jobs have the potential for machine replacement, and 60% will have at least 1/3 of their activities automated[iii]	80% of the skills trained for in the last 50 years can now be outperformed by machines[iv]

There will continue to be a shortage of workers with the skills that industry is seeking. The old education playbook isn't honed to prepare students for the jobs of the future. Many people will have to transition from "traditional careers" where they've trained to do specific tasks (e.g., mechanical engineer) to "multitrack careers" where they'll hold multiple simultaneous jobs such as engineer, data analyst, and network administrator.

Education 4.0, digital natives, and the importance of play/active learning

Children are growing up surrounded by technology their parents could not have imagined. The reach of Industry 4.0 technology is extensive and developing each day. The combination of new technology and digital-native students is propelling changes in the academic ecosystem, with emerging trends being branded as "Education 4.0."

For example, the movement toward play/active learning provides an opportunity for educators to have a significant impact on the Industry 4.0 talent supply. When technology topics are introduced in kid-friendly and play-directed ways, youngsters can become comfortable with and prepared for fluency in Industry 4.0 technologies earlier, and be more inclined to gravitate toward technical fields of study and careers. To foster this learning, educators should start as early as K–8 and avoid being constrained by the traditional perceptions of classroom dynamics. Play/active learning becomes an especially critical engineering outreach tool when a student has no other connection, association, or means of becoming aware of technical career opportunities. Students need the right tools so they can learn how to act on their inspiration.

3D basics to advanced skills

AUTODESK® TINKERCAD® → AUTODESK® FUSION 360®

Autodesk offers opportunities for students of all levels to learn 3D design and engineering skills. Once they've mastered basics, students can easily transition to gain more advanced skills. And because these tools are available online and on Chromebooks, accessibility is not an issue.

"The disruptions associated with Industry 4.0 are forcing both industry and educators to in essence reset, recalibrate, and create new types of collaborative partnerships."

David Pistrui, Ph.D., Clinical Professor of Engineering
University of Detroit Mercy
Co-Author, *Closing the Skills Gap in Engineering Education: A Multidimensional Perspective*

"Prior to Fusion 360 software, we actually ran and trained students on two separate CAD and CAM software packages. With Fusion 360, CAD and CAM software comes in one package. Training students to use the software is much simpler than anything we'd done before. The software enables us to really get into the nuts and bolts of Okay, let's model. Let's assemble this component, and now let's go out to the shop, and let's program and manufacture it. Fusion 360 gave us a lot more hands-on time with the students."

Jeremiah Williams, Director, Integrated Machining Technology
Danville Community College

Adapting curriculum to close the skills gap

The research finds that immediate and sweeping educational reform is needed to address the skills gap resulting from Technology 4.0. Even beyond the US border, similar skills gaps exist. For example, the majority of engineering students in India study a curriculum that is decades old and theoretical in nature. Only 46% of all graduates from Indian colleges are considered employable.[v] What is the Education 4.0 content and curriculum you need to evolve your mechanical engineering education to support multitrack careers?

Successful engineering and engineering technology education must incorporate contemporary Industry 4.0 subject matter, such as advanced software skills and artificial intelligence (AI) courses. The research also noted that industry liaisons requested more curriculum that focused on employability skills such as collaborative problem-solving. In addition, the need for hands-on experience is still truly relevant. Educators emphasized that there is no virtual replacement for the visceral experiences involved with fabrication, assembly, use, and maintenance. This means changing the way technical skills are taught in order to free up time for students to develop more team-building and employability skills as well as spend more time in labs and workshops.

"Academia and Industry needs to evaluate how we are training the workforce in the era of Industry 4.0 and beyond. The exponential pace of technological change demands a significant shift in paradigm."

Dr. Shuvra Das, Professor of Mechanical Engineering
University of Detroit Mercy
Co-Author, *Closing the Skills Gap in Engineering Education: A Multidimensional Perspective*

The importance of credentials

As the digital era moves forward, the application of machine learning (ML) and AI will alter the course of study. This means that competency testing and credentialing must change, as the concept of the one-size-fits-all engineering degree is no longer suitable. The Industry 4.0 workforce is holding credentials and lifelong learning in higher value. Providing the means to learn at the pace of Industry 4.0 can be key to attracting the workforce of tomorrow. Academic institutions must provide the platform through which students can build their dossiers of skills and credentials. Dossiers must be fully vetted, sanctioned, and transferable across industries.

> "We believe that converting the work done as part of the degree course into specialized, industrially recognized technology certifications should be the norm for our industry. For example, we put all first-years through the Fusion 360 certification. For us, it has yielded immense benefits. The students get an early opportunity to see the results of their hard work in the module whilst beginning their journey to job readiness. Lots of them left the certification sessions really pleased that they had passed, as it validated their skillset."

Dr. Simon Leigh, Associate Professor
University of Warwick

III. FINAL THOUGHTS AND RECOMMENDATIONS

Educators, industry leaders, and policy makers need to collaborate to make immediate and sweeping educational reform to keep pace with the advances of Industry 4.0 technology. Specifically, educators need to:

· Engage with industry leaders to rapidly develop new, relevant curricula, integrate Industry 4.0 technology, and reintroduce employability skills.

· Adopt new methods for reliable, transferable credentials and certifications.

· Get started now, without waiting for COVID-19 to recede.

> "Industry 4.0 is forcing companies to face digital disruption with a sense of urgency. Academia needs that same sense of urgency if we hope to properly fill the digital workforce pipeline."

Dr. Darrell Kleinke, Professor of Mechanical Engineering
University of Detroit Mercy
Co-Author, *Closing the Skills Gap in Engineering Education: A Multidimensional Perspective*

To learn more about preparing students for the jobs of tomorrow, [download the full report](#).

[i] Lavea Brachman, 2018. "Aligning Young Adults & Working Families Strategies to Job Training Needs in SE Michigan." Presented at MAGMA, Advisory Council, Auburn Hills, MI.

[ii] Brianna Lee Welsh, "Education 4.0 - How We Will Learn in the Fourth Industrial Revolution," *Medium*, April 17, 2018,
     https://medium.com/@brianna_91610/education-4-0-how-we-will-learn-in-the-fourth-industrial-revolution-e17206b73016

[iii] Ibid

[iv] Ibid

[v] "India Skills Report finds 46.21% of students employable," *The Hindu BusinessLine*, December 10, 2019.
     https://www.thehindubusinessline.com/news/education/india-skills-report-finds-4621-of-students-employable/article30269722.ece