3DEXPERIENCE® Edu

NAVIGATING INDUSTRY DISRUPTION

Dassault Systèmes - your trusted partner in transforming engineering education

The engineering landscape is undergoing a period of unprecedented transformation. Emerging technologies like electric vehicles, robotics, artificial intelligence, and sustainability challenges are disrupting traditional industries, demanding a new generation of engineers equipped with the skills to navigate this evolving landscape. Academic institutions face a significant challenge: ensuring their curricula remain relevant, preparing students for these in-demand skillsets, and fostering a culture of innovation that aligns with industry needs.

This white paper explores how Dassault Systèmes with its Education department **3D**EXPERIENCE® Edu may become your trusted partner in navigating this disruption. We will delve into the profound changes impacting various industries and the corresponding skillsets required for future engineers. We will then analyze the challenges faced today by academic institutions in adapting their educational offerings.

We will also showcase how **3D**EXPERIENCE Edu offers a comprehensive suite of solutions called "Education Experiences" specifically designed to accelerate and support these necessary transformations.

DASSAULT SYSTEMES

1. INDUSTRY TRENDS AND REQUIRED SKILLSETS

Imagine stepping into a factory and seeing robots working alongside humans, or picture a world where electric cars dominate the streets and drones zip through the sky delivering packages. This isn't science fiction – it's the future we're hurtling towards, and industries across the board are transforming at breakneck speed. From soaring aerospace advancements to the rise of self-driving vehicles and the increasing automation of factories, the engineering landscape is facing a wave of disruption. But, are engineers prepared to ride this wave, or will they be left behind? This chapter dives into the heart of these industry transformations, exploring the specific skillsets demanded by this exciting yet challenging new landscape. So, buckle up, and let's explore what the future holds for engineers in some industries:

- **Electric, Connected, and Autonomous Vehicles (eCAVs):** The rise of eCAVs necessitates expertise in electric powertrains, battery technology, connectivity systems, sustainability (LCA, materials) and artificial intelligence (AI).
- **Aerospace & Defense:** Sustainability concerns are driving the need for engineers who understand lightweight materials, efficient propulsion systems, and life-cycle environmental impact.
- **High-Tech/Consumer Electronics:** The convergence of disciplines like electrical, mechanical, and software engineering is crucial in this sector. Complementary challenges in their production plants that need to deploy massively robots and cobots.

2. CHALLENGES IN ENGINEERING EDUCATION: BRIDGING THE GAP BETWEEN EDUCATION AND INDUSTRY

Engineering education is undergoing a revolution! Driven by the breakneck pace of technological innovation, the field demands not just theoretical knowledge, but also the ability to put that knowledge into action. The exciting news? Educational programs are starting actively adapting to bridge this gap and empower future engineers to thrive in this ultra-dynamic landscape.

- **Striking the Right Balance – Theory Meets Practice:** Imagine an engineering education that seamlessly integrates theoretical concepts with the practical realities faced by industry. This is the future we're building. Borrowing from the wisdom of philosopher Immanuel Kant, who said *"Experience without theory is blind, but theory without experience is mere intellectual play,"* we recognize the crucial role of both elements. A strong foundation in theory provides a solid base, while practical application brings those concepts to life. By incorporating cutting-edge advancements like generative design, sustainable materials, and artificial intelligence, engineering curricula can ensure graduates possess not only the knowledge, but also the tools to tackle today's pressing industry challenges.
- **Building Problem-Solving Engineers:** Engineering is all about taking what you know and applying it to create impactful solutions. Forget memorizing formulas – the future lies in tackling real industry challenges. Courses are more and more ditching textbook problems for tangible projects that get students thinking critically, connecting different disciplines, and preparing for the messy realities of their careers. Imagine designing a sustainable water purification system for a developing community. That's the kind of hands-on experience that turns students into problem-solvers and innovators.
- **Interdisciplinary Collaboration:** Modern engineering projects rarely exist in silos. Successful products require a team effort, with mechanical engineers working alongside software developers and electrical engineers. Here's where fostering collaboration becomes crucial. Programs and projects that emphasize communication and teamwork skills equip students to function effectively in these interdisciplinary settings, mirroring the real world. This collaborative approach strengthens communication, but more importantly, it fosters a deeper understanding of how different engineering disciplines work together to achieve a common goal.

Electric vehicle (EV) sales are expected to account for 51% of the global market share by 2030, highlighting a major shift towards electrification.[1]

Investment in autonomous vehicle technology is projected to reach $200 billion by 2030, underlining the industry's commitment to self-driving cars requiring a systems engineering approach.[2]

The European Union has set a target of reducing CO2 emissions from aviation by 55% by 2030 compared to 2005 levels, on the way to achieving climate neutrality by 2050, highlighting an important acceleration to tackle sustainability related engineering challenges.[3]

The global advanced air mobility (AAM) market is expected to reach $9 billion by 2025, with a CAGR of 13% for the period 2020-2030, reflecting a growing emphasis on unmanned aerial vehicles (UAVs) for both commercial and military applications.[4]

"Investment in additive manufacturing technologies is projected to reach $37.2 billion by 2026", reflecting the potential of this technology to revolutionize product design and production.[5]

The space market, for example, has grown to approximately $447 billion and could grow to $1 trillion by 2030. The number of active satellite could triple within the next decade, underlining behind the space industry immense growth innovation, production and sustainability challenges.[6]

The global market for industrial robots is expected to reach $65 billion by 2028, indicating a growing reliance on automation and robotics in manufacturing processes.[7]

- **Lifelong Learning – A Core Competency:** Engineering is a field in constant flux, demanding continuous learning and adaptation. The most successful engineers are lifelong learners. Innovative programs are integrating "Learn to Learn" strategies, fostering a culture of continuous improvement. By encouraging students to embrace new technologies, constantly sharpen their skills, and stay relevant in a dynamic industry, these programs empower graduates to thrive throughout their careers.

Addressing these areas is crucial for ensuring that engineering graduates have the skillsets they need to not only land a job but also thrive as leaders and innovators in the fast evolving engineering landscape. The following chapter explores how innovative teaching approaches and powerful partnerships can help bridge this gap and empower the next generation of engineers.

Only 40% of engineering graduates feel confident in their ability to apply their skills to real-world problems.[8]

3. ENGINEERING EDUCATION TRANSFORMED: FROM TEXTBOOKS TO INDUSTRY-READY SKILLS

The previous chapter highlighted the challenges of traditional engineering education. This chapter delves into the exciting transformations happening in engineering education. We'll explore innovative approaches that move beyond traditional, textbook-focused learning to equip graduates with the practical, industry-relevant skillsets they need to excel in this fast changing world.

- **Building a Bridge Between Theory and Reality:** What truly empowers engineers is the ability to apply fundamental-principles to solve real-world industry problems. Imagine graduating with a theoretical understanding of mechanics, but lacking the know-how to utilize cutting-edge simulation software to analyze a real-world plane design. It means that it's important to integrate industry-realistic use cases into the curriculum. Think of it as building a bridge between theory and practical application, ensuring students graduate with the skills and confidence to hit the ground running in their careers.
- **Virtual Twins: Stepping into the Heart of Industry** Traditionally, engineering education has relied heavily on textbooks and lectures, often leaving students struggling to connect theory to real-world applications. This can make it difficult for them to feel fully prepared for the challenges they'll face in their engineering careers. That's where industry-realistic virtual twins come in, offering a transformative teaching playground for educators. Virtual twins are digital representations of industry/real-world systems or processes. Imagine a 3D model of an autonomous electric car or a complex factory floor – whatever the scale, the model allows you to bring industry in your classroom! Albert Einstein famously stated, *"The only source of knowledge is experience. Everything else is just information."* Virtual twins embody this philosophy, offering a powerful tool to connect theoretical knowledge and practical engineering/learning experience. Finally, virtual twins offer a realistic industry environment that is beneficial to both educators and students:
  - **Enhanced Learning Resources:** Virtual twins provide educators with a powerful tool to create engaging and interactive learning experiences. They can be used to supplement existing curriculum materials or develop entirely new, project-based learning activities.
  - **Apply theoretical knowledge:** By engaging with virtual twins, students can see engineering principles come to life in a practical context. This reinforces understanding and allows them to make connections between the theoretical concepts learned in class and their practical applications.
  - **Develop critical problem-solving skills:** Virtual twins present students with opportunities to experiment with different design approaches and analyze the consequences of their decisions within a safe, virtual environment. This fosters critical thinking and problem-solving skills, equipping them to tackle real-world challenges with confidence.
  - **Improve Student Engagement:** The industry realistic nature of virtual twins fosters a deeper level of student engagement in the learning process. This can lead to increased motivation and improved learning outcomes.

- **The Power of Multidisciplinary Collaboration:** Modern engineering projects are rarely the domain of a single discipline. A successful self-driving car, for example, requires seamless collaboration between mechanical engineers, software developers, and electrical engineers. Here's where multidisciplinary collaboration becomes key. Forward-thinking programs promote teamwork across disciplines through collaborative projects that mirror real-world/industry scenarios. Imagine a team of students tackling a project to design a sustainable water purification system for a developing community. This approach not only fosters communication and teamwork skills but also equips students with a deeper understanding of how different engineering disciplines work together to solve complex problems.
- **Immersive Learning: Experiencing Engineering.** Immersive learning technologies like VR and AR take student engagement to a completely new level, offering a significant boost to learning efficiency. These technologies are not just about seeing realistic industry environments – they allow students to experience them firsthand. Imagine a student using VR to virtually walk through and interact with the virtual twin of their real electric car. This goes beyond simply analyzing a picture or diagram. They can manipulate components, test design concepts, and even experience the consequences of their virtual modifications – all in a safe, controlled environment. Here's the power of immersive learning:
  - **Learning by Doing:** By actively engaging with 3D models in a virtual environment, students gain a deeper, more intuitive understanding of engineering concepts. They're not just passively memorizing theoretical principles; they're experiencing them firsthand, which leads to better knowledge retention.
  - **Reduced Cognitive Load:** Immersive learning environments alleviate the need for students to mentally translate abstract engineering concepts into real-industry scenarios. They can directly experience the applications of engineering principles, reducing cognitive load and fostering a more natural grasp of the material.

This "multi-sensory" approach to learning not only boosts engagement but also accelerates the learning process. Students gain a stronger understanding of engineering concepts and their practical applications in a way that traditional methods simply cannot replicate. By the way, educators are remaining at the core of the activities, centered on their major expertize – defining the right and new teaching approaches (pedagogy & scenarios).

- **Empowering Innovation Through Cutting-Edge Technologies:** The engineering landscape is evolving at breakneck speed. Emerging technologies like engineering platform, AI, data science, and cybersecurity are transforming industries. Here's where visionary educational programs integrate these advancements into the curriculum, ensuring students graduate with the in-demand skills needed to be at the forefront of innovation. Think of it as equipping them with the latest tools and technologies to tackle the challenges of tomorrow.
- **Learning by Doing – Project-Based Learning with Real-World Relevance:** Rote memorization is outdated. The future of engineering education lies in project-based learning where students are actively engaged in tackling real-world problems. Imagine a project where students design and simulate a prosthetic limb using 3D printing technology: that's the kind of hands-on experience that truly prepares students for the practical realities of their future careers.
- **Lifelong Learning – The Cornerstones of Success:** This means that the knowledge an engineer acquires today may only be relevant for a handful of years before advancements necessitate an update. This rapid evolution underscores the importance of fostering a "Learn to Learn" mindset in future engineers. This approach isn't just about cramming information – it's about becoming a lifelong learner, someone who can roll with the punches of a changing landscape. By mastering "Learn to Learn," engineers become champions of adaptation, readily embracing new tools and trends. They keep their knowledge base fresh for their entire careers. But "Learn to Learn" goes beyond that. It fosters independent learning and critical thinking. This translates

Project-based learning can improve student problem-solving skills by up to 48%[9]

The half-life of engineering skills is estimated to be around 5 years due to rapid technological advancements.[10]

to engineers who can tackle complex problems head-on and dream up innovative solutions – essential skills for thriving in the ever-changing world of engineering. They become problem-solving powerhouses. Finally, "Learn to Learn" transforms learning from a finish line into a never-ending journey. By nurturing this mindset, students develop a passion for continuous learning and exploration. This fuels their curiosity and motivates them to stay sharp on the latest advancements in their field. It's a virtuous and necessary circle!

By embracing these transformative approaches with a focus on industry-realistic use cases and multidisciplinary collaboration, engineering education can empower graduates not just with theoretical knowledge, but with the practical skillsets and adaptability needed to thrive as leaders and innovators in the dynamic engineering landscape of tomorrow. The next chapter explores how Dassault Systèmes and its education department **3D**EXPERIENCE Edu can empower academic institutions to implement these innovative approaches and prepare the next generation of engineers and innovators.

4. DASSAULT SYSTÈMES AND 3DEXPERIENCE EDU: TRUSTED PARTNERS IN ENGINEERING EDUCATION TRANSFORMATION

Dassault Systèmes, a key player in industry transformation through its advanced engineering software and scientific solutions, is actively addressing education challenges through **3D**EXPERIENCE Edu. This chapter explores how **3D**EXPERIENCE Edu positions itself as a trusted partner for academic institutions, collaborating globally to bridge the gap between industry needs and graduate skillsets.

3DEXPERIENCE Edu: Addressing Skill Gaps

As highlighted earlier, industries require engineers equipped with new skillsets to navigate emerging technologies and changing paradigms. **3D**EXPERIENCE Edu acknowledges this skill gap and offers a comprehensive suite of solutions to tackle it:

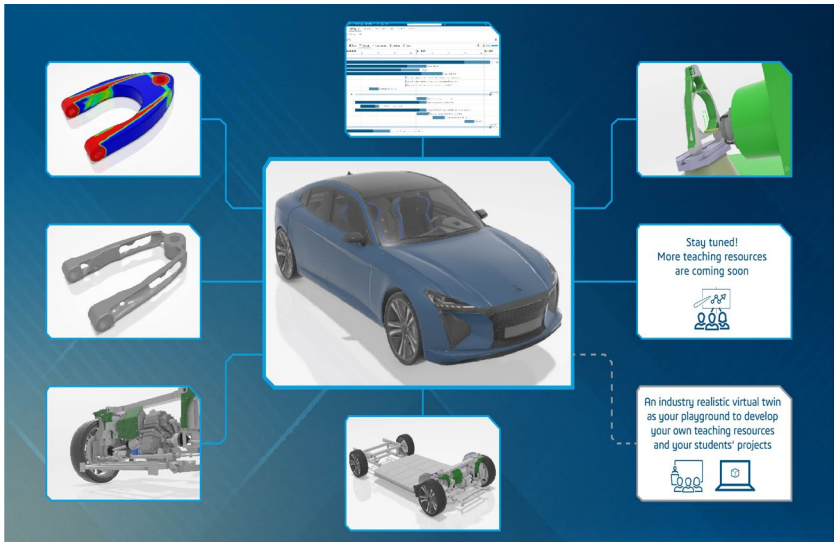
- **Teaching Content & Curriculum Development: 3D**EXPERIENCE Edu collaborates with academic institutions to define and/or develop curricula that integrate industry-relevant tools and practices. This might involve incorporating Dassault Systèmes' solution like **3D**EXPERIENCE with CATIA/SOLIDWORKS for design, SIMULIA for simulation, DELMIA for digital manufacturing (and more) into coursework.
- **Building Trust Through Collaboration: 3D**EXPERIENCE Edu DNA is education! A collaborative approach with/for academic institutions, we build trust and empower institutions to adapt their educational offerings.
- **Needs Assessment and Customization: 3D**EXPERIENCE Edu works closely with academic institutions and Educators around the world to understand their specific needs and goals. Teaching and Learning assets are then customized to address those generic academic specific requirements.
- **Focus on Learning Outcomes:** The core emphasis is on student learning outcomes as skills. **3D**EXPERIENCE Edu works with institutions around the world to adapt/revamp/co-develop programs that demonstrably equip graduates with the skills and knowledge demanded by industry.
- **Streamlining the academic transformation: 3D**EXPERIENCE Edu offers a unique and powerful value proposition with Education Experiences. This comprehensive approach goes beyond simply providing software. It fosters an industry realistic learning environment with teaching/learning content, Virtual twins, 3DAssets that empowers educators to equip students with the skills expected by industry. They empower educators to:
  - Deliver engaging and industry-relevant curricula respecting academic constraints
  - Develop students' critical thinking and problem-solving skills (by connecting the disciplines, by developing a "platform mindset")

Education Experience: Structure and Concepts

Our experiences leverage industry-standard software applications like **3DEXPERIENCE**, coupled with realistic virtual twins of real-world systems. Educators face the challenge of delivering a comprehensive curriculum within a limited timeframe. Our education experiences are designed to be flexible, offering both a horizontal and a vertical learning approach:

- **Horizontal Learning:** This approach provides a bird's-eye view of real-world engineering scenarios. Students are exposed to an industry scenario that break down disciplinary silos, fostering a holistic understanding of the engineering process. They understand how key skills like communication, teamwork, and platform thinking, are essential for success in today's engineering landscape.
- **Vertical Learning:** This approach allows for deeper dives into specific disciplines. Students can use our experiences to focus on honing specific skills in areas where they need further development. This targeted approach complements the horizontal learning and ensures a well-rounded skillset.

- Prepare graduates for successful careers in a rapidly evolving engineering landscape (by providing industry realistic virtual twin)



Virtual Twin – an industry realistic teaching/learning playground

By incorporating industry best practices, realistic virtual twins, and a flexible learning format, our Education Experiences offer a powerful, efficient learning package. Students gain the knowledge, practical experience, and collaborative skills needed to not only graduate as job-ready people but also to thrive in the dynamic and multi-disciplinary world of engineering.

5. CONCLUSION

Dassault Systèmes, through **3D**EXPERIENCE Edu, is not merely a software provider; it is a trusted partner in the transformation of engineering education. By understanding industry trends, academic challenges, addressing skill gaps, and fostering a culture of innovation, **3D**EXPERIENCE Edu empowers academic institutions to prepare future engineers for success in a rapidly evolving technological landscape. This collaborative approach fosters trust and ensures that graduates are equipped with the necessary skillsets to become the driving force behind tomorrow's technological advancements.

By partnering with Dassault Systèmes and embracing Education Experiences, academic institutions can future-proof their engineering programs and ensure their graduates are not just task-ready, but industry-ready.

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Endnotes

1 Source: Bloomberg
2 Source: Grand View Research
3 Source: ICAO
4 Source: McKinsey
5 Source: Statista
6 Sources: McKinsey
7 Source: Statista
8 Source: ASEE Prism
9 Source: Edutopia
10 Source: World Economic Forum