Multimodal Meets Blended Learning:
The future of engineering education
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In recent years, multimodal learning and the role of technology in the classroom have been popular discussion points amongst educators. In this white paper, we’ll explore the benefits of multimodal learning, specifically as it applies to engineering education. Next, we’ll take a look at blended learning and the critical role it plays in bringing multimodal education to the classroom. Looking towards the future of engineering and manufacturing careers, we’ll discuss why multimodal, blended learning is the best option for preparing students to enter the workforce. Finally, we’ll show you how a multimodal curriculum can be implemented using our online tools.
Why multimodal learning?

As we begin exploring these topics, we must first understand what multimodal learning is and why it’s such an important educational tool.

What is multimodal learning
Multimodal learning engages the brain in learning through more than one mode or media at a time. For example, if an instructor presents a new concept to their class using a PowerPoint, they’ve combined text and imagery with their oral lecture to engage their students through visual, auditory, and written modes of communication. This is a classic example of multimodal learning.

To many, multimodal education is a method of engaging the various learning styles represented in every classroom. While the impacts of multimodal learning stretch far beyond this view, it’s a helpful starting point to fully understand the importance and benefits of multimodal education.

Learning styles
There are many different approaches to and classifications of learning styles. In general, the term “learning styles” refers to the different modes of learning and the ways in which students prefer to learn. Some people prefer to learn by doing things, while others would prefer reading about a topic. Each of these preferences corresponds with different modes through which information is communicated.

Of the well over 70 different learning style schemes, arguably the most popular is VARK. Within the VARK approach, learning styles are split into 4 categories:

- **Visual**
  Visual learners prefer to learn new information through text, images, and visual representations of concepts such as graphs, pictures, and diagrams.

- **Aural or Auditory**
  Aural or auditory learners prefer to take in information through sounds, stories, discussion, lecture style presentation, podcasts, and the like.

- **Read/Write**
  Read/write learners prefer to use lists, note taking, and text to learn information.

- **Kinesthetic**
  Kinesthetic learners prefer to absorb information through physical action, sometimes in the form of hand-eye coordination, walking while studying, and making 3x5 cards to study.

For years, it’s been assumed that allowing students to learn through their preferred learning style will help them to retain and understand more information. Research, however, suggests something different. In fact, a team of cognitive psychologists led by Harold Pashler evaluated the research on learning styles in 2009. Their team confirmed that there’s no evidence to support the idea that instruction is best provided in a format that matches the preference of the learner.

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With this in mind, experts have turned to exploring the impact of learning through multiple styles and the association between learning styles and disciplines. Recent research shows that learning in multiple ways reinforces knowledge and produces different kinds of information – underlining the need for a multimodal approach.

Connecting styles and fields
While Pashler's team was unable to substantiate any connection between learning style and retention, they were, however, able to determine that there is ample evidence to connect learning styles with specific disciplines. For example, individuals studying or pursuing a career in design will likely find visual learning activities more impactful and effective for learning design than other types of activities.

This is a particularly important detail to consider when teaching students the concepts and practices of engineering, manufacturing, and design. Throughout the engineering and manufacturing process, individuals are required to use software, create drawings, communicate across teams, maintain meticulous notes and files, produce a physical product, and much more. All of which requires you to engage in multiple types of activities.

This is just one aspect of the engineering lifecycle and it requires skills based in all four of the learning styles outlined in VARK. When you consider the many other facets of engineering, it's clear that for students to best set themselves up for a successful career, they need an educational program that emphasizes a multimodal approach to learning.

The question we have to answer next is, "How can modern educators best incorporate multimodal learning into their curriculum?" While there are many different approaches to this, technology, such as mobile devices and the Internet of Things (IoT), provides unique opportunities and benefits to students.

The role of blended learning in multimodal education
Traditionally, different styles of learning have been thought about separately because of the disparity in their representation. Textbooks, composition, and practice activities have been very singular in the types of engagement they provide.

In the digital age, we rarely interact with content or participate in learning activities that are singular in mode. Forcing us to look at modes in a more holistic manner. We now have to consider how different modes inform, interact with, and give meaning to each other.

This integration of modes also forces us to examine the role technology plays in education. As we become conditioned to find answers on our phones and interact with different types of learning content through the IoT, technology becomes the backbone to our primary learning experiences.

This is why blended learning is so important to a multimodal education. Technology has reshaped the context of what it means to learn, created a world in which multimodal learning is a necessity, and provides students with the tools they need to be successful.

What is blended learning?
Blended learning uses online learning in conjunction with traditional face-to-face teaching to provide students with a richer, more personal education.
The power of elearning

Dr. Bill Cope, an expert in the theories and practices of pedagogy, has done extensive research into the benefits of blended learning. In his Seven e-Affordances of using technology in learning, he specifically examines the connection between multimodal learning and technology.

Powerful learning, according to Dr. Cope, involves a shift from one mode to another. With the introduction of technology into a student's curriculum, this switching becomes better integrated into their learning experience. Students no longer need to fully stop and switch from one activity to another, but rather naturally progress from one mode to another, often using multiple modes at a time.

What's more, through the use of personal devices, multimodal resources can easily be made available to students on any device they might own. This is a difficult feat to achieve without technology as it relies more heavily on students' individual resources. By meeting students where they already are, instructors provide a more even playing field with better resources and improved opportunities to learn.

A personalized education

While it would be incredibly difficult (if not impossible) for an instructor to provide a personalized education to each of their students, online learning can help make this possible by providing a variety of tools to assess a student's skills.

According to a 2011 study by Jeffrey Karpicke and Janell Blunt, when students can learn at their own pace and aren't distracted by the environment of the classroom, they score better on retrieval-style questions. This style of learning is considered to be tutor-based by the definitions within the study.

The reason tutor-based learning is so effective is because of a student's ability to take charge of their education. When students get stuck, the ability to easily switch back and forth between different learning experiences allows the student to essentially build their own curriculum and learn at their own pace.

In utilizing online learning technologies, you provide your students with the ability to answer questions as they arise through access to more learning content and a variety of learning experiences. Not only is this type of learning effective in improving a student's retention, but it also has an impact on their passion for a topic.

For students in a standard program, about 50% score above median performance.

For students in a tutor-based program, that number goes up to 98%.

Cultivating a passion

In their book, New Learning: Elements of a Science Education, Mary Kalantzis and Dr. Bill Cope explained giving students the ability to co-design their own education is essential to transformative learning. Through transformative learning practices, students are forced to take on a more active role in and reflect on their own learning. As a result, students develop a deeper understanding and passion for the topic they are studying.

Coined by Dr. Jack Mexirow, transformative learning theory concludes that students expand their consciousness and reshape their worldviews by taking a more active role in the building of their education.

Providing students with an elearning tool grants them the ability to take charge of their education. Through features such as the ability to pause and go back as needed and the resources to explore related topics, you not only help provide students with an education that best suits their individual needs, but you also empower them to find passion in their studies. This kind of cultivated passion is exactly what students need to help drive them to keep learning once they find a career in engineering.

1 Jeffrey D. Karpicke and Janell R. Blunt, Retrieval Practice Produces More Learning Than Elaborative Studying with Concept Mapping, Purdue University, 2011.

An education that supports career readiness

The role of education is to set students up for success upon leaving school. As students graduate and begin entering the engineering and manufacturing workforce, they often find it difficult to secure a job. This difficulty is largely attributed to the skills gap.

Addressing the skills gap
The skills gap occurs as industry vets take their tribal knowledge and best practices with them when they retire. In general, engineering education often lacks the kind of real-world experience employers are looking for. Using blended learning, however, instructors can help students gain a deeper understanding of the tools and techniques they will be using in the workforce by bringing more hands-on CAD, CAM, and BIM projects into the classroom.

Dr. James Paul Gee, Presidential Professor of Literacy Studies at Arizona State University, has famously compared this style of learning-by-doing to playing video games. He explained that, while you can read a manual about how to play a video game, you’ll benefit more by having the actual experiences of playing. As you gain experience in playing the game, what you read in the manual gains context and helps you master the game. In this same way, when we couple traditional textbook learning with hands-on, experienced based training, students are better setup for success.

By incorporating elearning into students’ curriculum, teachers can help engineering students get the kind of hands-on experience they’ll need as they enter the workforce. With experience using different software titles and completing real-world projects, students gain a competitive edge in the job market. For an even greater advantage, students can leverage some of these tools to earn certifications to prove their skills in using the software and techniques potential employers are looking for.

The future standard skillset is multimodal
The future of careers in engineering and manufacturing is evolving to include a demand for more expanded skillsets. This means that students must not only enter the workforce with an extensive knowledge of the theories and practices of engineering, but they must also be prepared to learn new skills as their career progresses.

Consider how the convergence of coding and design is creating the need for a whole new kind of product designer. As technology becomes increasingly integrated into everyday products, such as children’s toys and digital scales, product designers must know how to effectively incorporate the appropriate coding and mechanics into their designs. The future standard skillset of an engineer or designer will have to include an in-depth understanding of coding and software integration to ensure the usability and operability of their products.

Only 55.6% of college educated students are in jobs that require a college degree, meaning they need every advantage entering the workforce.

As technology becomes further integrated in the products we use daily, growing the IoT, having the ability to grow one’s skillset will become crucial to a successful career. Students not only need to be able to pick up new skills and have a resource with which to do this, but they also need to know how to learn in a variety styles. As discussed earlier, students learn best when the learning style is a reflection of discipline.

Using online learning tools with multimodal learning activities, you help expose students to learning experiences you may not be able to otherwise provide. Students benefit from a fuller, broader education.

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Preferent students for lifelong learning

As our society continues becomes more interconnected through the IoT, learning is no longer an activity saved for being a student. Not only must students be prepared for their careers with expanded skillsets, they must also be prepared to learn throughout their careers.

It wasn't long ago that our paths for learning in life were fairly straightforward - you went to school before moving on to college and, after graduating, you began your life as a working professional. You presumably would have learned everything you'd need to know for the different phases of your career during your time as a student. There wasn't much of a need to think about education and learning past those primary milestones.

As the job market in engineering and manufacturing continues to change, students must be ready to continue learning throughout their lives. According to a survey from the Pew Research Center, more than half of all working Americans think that they will need to develop new skills during their career. The same survey showed that 45% of working Americans have enrolled in a class or sought out extra training to learn and improve their skills.

54% of working Americans think they will need to learn new skills through the course of their career.

45% of all working Americans enrolled in a class or sought extra training to improve their skills.

Education professionals can help give students a leg up by instilling in them a dedication to knowledge and learning, and developing the skills they need to successfully engage in lifelong learning.

Passion, skills growth, and career readiness are dependent upon providing students with the appropriate resources. By giving students a full-featured, online learning tool that empowers them to take part in crafting an education that mirrors their discipline, you send students into the world better set up to succeed.

Today, that approach simply isn't practical. According to a recent report from IBM Marketing Cloud, 90% of the world's data was created in the past two years alone.

Looking specifically at engineering and manufacturing, the creation of new data and advancements in technology have lead to major shifts in the job market. Much of what used to be done manually has been replaced by automated options that improve speed and efficiency, leading to a number of old jobs being lost and, ultimately, the creation of new job opportunities.

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1 IBM Marketing Cloud, 10 Key Marketing Trends For 2017, December 2016.
2 Anna Brown, Key findings about the American workforce and the changing job market, Pew Research Center, October 2016.
Implementing multimodal and blended learning in the classroom

Looking back at this discussion, there are many benefits to providing students with an elearning resource that emphasizes multimodal learning. At SolidProfessor, we’re shaping the next-generation of engineering education. Our approach to continuous learning through online, on-demand, video-based courses ensures students get the education they need.

**Built to help you do more.**
Our microlearning-based approach to training and ongoing learning allows you to focus on engaging with students, while helping them retain more information and find the answers they need.

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**Excite your students’ curiosity**
Engage students through visual, auditory, read/write, and kinesthetic learning with interactive exercises and downloadable file parts built into our video-based courses.

**Tailor lesson plans to your student needs**
Easily build and modify your online program for students. Assign courses to supplement your in-class lessons and monitor students’ progress from a single dashboard.

**Set your students up for success in the workforce**
Help students close the gap between theory and applied skills, and begin earning the industry recognized certifications employers look for.

**Measure and track progress**
Manage all your students’ data to ensure they’re retaining information and developing their skills in alignment with state and industry standards.

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**Don’t let your budget hold you back**
SolidProfessor’s Technology Grant Program provides schools and universities with an opportunity to leverage industry-leading curriculum and training material at only a fraction of the commercial price. You can contact SolidProfessor here to apply for our Technology Grant Program and help bring multimodal, blended learning into your classroom.

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“SolidProfessor’s quality is amazing. The lessons are clear, concise, and effective. When students tap into it, they don’t get bored quickly. For students to be able to pause when they need to, or stop and actually try it on their own, that’s really valuable for students.”

*Karcher Morris, UCSD*