An Overview of
The Online Engineering Academy

The Engineering Academy at Hoover High School

While there is some debate over whether the United States is facing an impending shortage of engineers, few – if any – would argue with the idea that the U.S. would benefit from high school graduates who are more technically knowledgeable and proficient. STEM education has been a hot topic in the pre-university world for a couple of decades, though the "E" – Engineering – has only become a focal point on a broad scale in the past decade. The Engineering Academy at Hoover High School was launched in 2004 with the expressed purpose of grooming high school students to excel in undergraduate engineering programs through rigorous and engaging coursework and daily interaction with engineering professionals – their teachers! To date the 65 graduates of the academy have received an average of $203,560 in scholarship offers, with 55 studying engineering and another six students majoring in a STEM field. The best part is that they are entering college ready for the challenge of an undergraduate engineering curriculum.

Expanding the Reach of a True College-Preparatory Engineering Curriculum

In his book *Disrupting Class*, Dr. Clayton Christensen predicts that "by 2019, 50 percent of high school courses will be delivered online." This statement may stir a range of responses from personal feelings about "online education" to unbelief that the landscape of high school education could change so drastically in such a short time. The change is occurring, though. Several states have online, or virtual, charter schools. Private schools and small public schools are using online courses to increase their course offerings. And, larger public schools are looking to online courses to relieve overcrowding issues. The combination of advances in e-learning technology and economic crises in education may speed the growth of online learning in high schools around the country. This growing interest in and acceptance of e-learning technology may provide the ideal platform for replicating the success at Hoover High School in schools around the United States.

The Online Engineering Academy – Bringing Engineers to Classrooms

The success of The Engineering Academy at Hoover High School is largely due to the faculty resources that are available. With four degreed engineers teaching in The Engineering Academy, the curriculum has not been written by engineers who do not understand high school students, nor has it been written by high school teachers with no engineering experience. The entirety of the curriculum is designed and delivered by engineers who have chosen to teach high school professionally. As engineers, they know what is required to earn an engineering degree and understand the engineering profession. As high school teachers, they understand high school students and how to effectively teach them difficult concepts and prepare them for what is required to become an engineer. They also understand the high school environment – something that should not be undervalued.

The Online Engineering Academy will leverage the faculty resources at Hoover High School, bringing experienced engineers/high school teachers to classrooms around the country. While these courses will be designed so that an individual student could take the course from home as part of a larger online "class," the ideal implementation will involve a blended delivery – where students meet in a school setting with a teacher who has been trained to facilitate hands-on activities, moderate class discussions, and assist in their development as writers and speakers. The online engineering courses will feature two primary components – well-designed content delivery and innovative communications tools – described in the following.

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- **Content Delivery**
  - Multimedia delivery of all engineering content in the SCORM and Common Cartridge format
  - Informal assessments built into the Learning Management System (LMS) as students move through new content to increase interactivity and retention
  - Open-ended, subjective assignments
  - Individual and group research and design projects
  - Formal assessments built into the LMS
  - Subjective technical writing assignments
  - Subjective technical presentations

- **Innovative Communications Tools – The Virtual Classroom**
  - Synchronous and asynchronous teacher-student, student-student, teacher-teacher using an integrated and customized implementation of Cisco's Training Center (including VoIP, multi-point video conferencing, interactive whiteboards, screen-sharing, file sharing, monitored real-time discussions, and more).
  - Online engineering notebook
  - Integrated, commonly used engineering tools, such as LabVIEW

The Online Engineering Academy – Bringing Engineering to Classrooms

With so many things masquerading as "engineering" at the high school level, it is important to clearly define what content will be included in The Online Engineering Academy. The mission of the online academy is the same as the traditional program at Hoover High School – to have "engineering professionals groom high school students to excel in undergraduate engineering programs." In order to do this, the online program must mirror the bricks and mortar program while taking advantage of the resources available via the Internet, such as the ability to use the virtual classroom to bring in guest experts from a myriad of engineering disciplines to address students. The curriculum will include the same four engineering courses and the same recommendations for math and science courses. The engineering curriculum includes the items listed below, in addition to engineering design process, technical writing, and technical/public speaking which are embedded in all of the courses.

1st year
- Drawing standards
- Two-dimensional and three-dimensional visualization
- Sketching techniques
- Three-dimensional solid modeling
- Maintaining an engineering notebook

2nd year
- Data acquisition & analysis
- Material properties
- Truss analysis
- Electrical circuits
- Digital signal processing
- Work and energy transfer

3rd year
- Fundamentals of computer programming
- Computational solutions using MATLAB
- Computational solutions using LabVIEW (preparation for Certified LabVIEW Associate Developer exam)
- Automated data acquisition using LabVIEW

4th year
- Fundamentals of business and entrepreneurship
- Short-term design projects that include market research, problem identification, definition of goals and constraints, development of multiple design alternatives, prototyping of selected design alternative, development of a business plan

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The Development Team

The development of The Online Engineering Academy is a collaborative effort that includes members of the engineering faculty at Hoover High School, support from Hoover City Schools, the technical expertise of SlateXP, and outside consultants. Key participants include:

Mark D. Conner, Ph.D. – Dr. Conner is the founder and director of The Engineering Academy at Hoover High School. His degrees are in mechanical engineering (UAB '91, Duke '93 and '96), and he has been teaching science and engineering full-time at the high school level for 15 years and undergraduate engineering part-time for 12 years.

Lee Ross – Mr. Ross is the President and CEO of SlateXP, a Birmingham-based e-learning and training services provider. Under his leadership, SlateXP has developed a cross-platform Learning Management System that allows for multimedia content delivery, secured and monitored social interaction, and integration with state-of-the-art technology tools.

Andy Craig – Mr. Craig is the Superintendent of Hoover City Schools. His support of the online development efforts includes building outside partnerships and providing financial support for the initial development phase.

David A. Conner, Ph.D., P.E. – Dr. Conner has spent the past 50 years working as an engineer and teaching engineering at the undergraduate and graduate levels, including 17 years as the Founding Chairman of Electrical and Computer Engineering at the University of Alabama at Birmingham. He is a licensed Professional Engineer in several states and has served as a technical consultant and expert witness in a variety of technical areas.

Anne Jolly – Mrs. Jolly is an educational consultant and professional writer who is serving as an external curriculum specialist, reviewing the pedagogy of the online curriculum. Her areas of focus include the development, writing, and implementation of middle grades engineering curriculum, the design and authoring of books on facilitating professional learning teams, the design, implementation, and support of professional learning teams, leadership training and support for school leaders and team facilitators, teacher quality and teacher leadership initiatives, and web-based professional learning communities and online assistance.