KEEN & ABET

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Almost every engineering college seeks ABET accreditation. But how does this fit with the KEEN Framework?

You may recognize that the KEEN Framework is split into two complementary parts: skillset & mindset. While mindset is the focus of KEEN, a specialized skillset supports the development of an entrepreneurial mindset. KEEN's skillset outcomes are comprised of three categories: Opportunity, Design, and Impact. *See page 26 for complete Framework*.

KEEN's Opportunity Outcomes drive discovery and curiosity. They promote the development of ABET outcomes in a rich context for student work. If you are already mapping ABET outcomes for your syllabi, you can easily connect them to KEEN. (Figure 1)

For example, *test concepts quickly via customer engagement* requires communication of the concept in a manner that the customer can understand and respond to, ABET #3 or [g]. *Creating a preliminary business model* introduces students to the operation of an enterprise as a system, a goal of ABET #2 and [c].

KEEN's Design Outcomes are consistent with those commonly used in capstone courses and support all of the proposed ABET Student Outcomes 1-7 and ABET Student Outcomes a-k.

KEEN's Impact Outcomes emphasize value creation in both economic and societal terms, giving students insight into the potential for improvement. You can directly couple these Impact outcomes with ABET requirements. For example, a *validation of market interest* directly maps to ABET #7 and [i].

The KEEN Framework supports accreditation requirements. It provides a rich environment for preparing students to enter the workforce after graduation. Students' ability to see the big picture and consider all impacts of an engineering solution improves our world.

Figure 1

KEEN OUTCOMES	ABET 1-7	ABET a-k
Opportunity: Identify an opportunity **Design**: Analyze solutions	**(1)** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	**[a]** An ability to apply knowledge of mathematics, science, and engineering **[e]** An ability to identify, formulate, and solve engineering problems
Opportunity: Create a preliminary business model **Design:** Develop new technologies **Impact:** Identify supply chains and distribution methods	**(2)** An ability to apply engineering design to produce solutions that meet specified needs with consider-ation of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	**[c]** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability
Opportunity: Test concepts quickly via customer engagement **Impact:** Communicate an engineering solution in terms of societal benefits **Impact:** Communicate an engineering solution in economic terms	**(3)** An ability to communicate effectively with a range of audiences	**[g]** An ability to communicate effectively
Opportunity: Evaluate technical feasibility, customer value, societal benefits, economic viability **Impact:** Communicate an engineering solution in terms of societal benefits **Impact:** Protect intellectual property	**(4)** An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	**[f]** An understanding of professional and ethical responsibility **[h]** The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context **[j]** A knowledge of contemporary issues
Design: Determine design requirements **Design:** Create a model or prototype **Impact:** Develop partnerships and build a team	**(5)** An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	**[d]** An ability to function on multidisciplinary teams
Opportunity: Evaluate technical feasibility, customer value, societal benefits, economic viability **Design:** Develop new technologies	**(6)** An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	**[b]** An ability to design and conduct experiments, as well as to analyze and interpret data
Impact: Validate market interest **Impact:** Identify supply chains and distribution methods	**(7)** An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	**[i]** A recognition of the need for and an ability to engage in life-long learning
Design: Develop new technologies **Impact:** Protect intellectual property	Implied in **(1)**, **(2)**, & **(6)**. Also required in Criterion 5 Curriculum.	**[k]** An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

> ABET's approach, the criteria and processes we use, and the quality we guarantee inspire confidence in the programs we accredit, whose graduates are building a world that's safer, more efficient, more comfortable, and more sustainable.
>
> It is remarkable to consider that over the last 20 years, since moving to "outcomes-based assessment," over 3,700 ABET accredited programs in 30 countries have established a local industry advisory board and have developed an internal Quality Management System to monitor and assess the program's own performance.
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> In the spirit of KEEN, this represents a true entrepreneurial mindset made actionable by a dedicated set of disciplined, well-trained volunteer experts.
>
> Joe Sussman
> Chief Accreditation Officer and
> Chief Information Officer
> ABET

> Mapping the entrepreneurial mindset to ABET criterion can reinvigorate a program's thinking about their curriculum.
>
> Joe Tranquillo
> Associate Professor
> Bucknell University

> Augmenting our ABET requirements with KEEN learning objectives allows us to better prepare our engineers for an increasingly competitive world.
>
> Chris Kitts
> Associate Dean & Professor
> Santa Clara University

> During the previous ABET visit to our campus in 2012, the ABET program evaluators were impressed with the entrepreneurial mindset activities that our students were experiencing both in the classroom and in extra-curricular activities, such as weekly innovation challenges and the iScholars program.
>
> Krishnaswamy Ravindra
> Professor
> Saint Louis University

> ABET's student outcomes specify the desired knowledge, skills, and behaviors of a graduating engineer. KEEN focuses on the simple truth that engineers are meant to help people by solving their problems, thereby providing an educational context that engages both students and faculty in attaining the ABET outcomes.
>
> John Estell
> Professor
> Ohio Northern University

> An important ABET student outcome addresses the ability to apply the engineering design process to produce solutions that meet specified needs. Clearly one of these needs may involve creating value for the product's stakeholders. Entrepreneurially minded learning aligns closely with this aspect of engineering design. Creating an entrepreneurial mindset early in the curriculum enables students to address value creation in their design projects culminating in their capstone experience.
>
> Jim Collofello
> Vice Dean
> Arizona State University