DESIGN ENGINEERS EVALUATE THEIR EDUCATION

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When asked, 83% of all participating design engineers agree that greater practical experience from their undergraduate training would have better prepared them for their first engineering job. This is one of many revealing findings of a survey that was conducted this past November by the A I A A Design Engineering Committee.

Atotal of 300 design engineers completed the 10-minute telephone survey. These engineers were selected from among approximately 31,000 A I A Amembers. Membership applications were used to narrow the list down to those non-student members who had graduated in or since 1992, and those who indicated a job category or interest in design work.

The survey determined that 85% of the respondents are currently doing design engineering while the rest have done some in the past, and 53% of them report doing "a lot" of design work. Seventy-two percent concentrated in aerospace or aeronautical engineering as undergraduates, while most of the rest concentrated on mechanical or structural engineering. Eighteen percent of the respondents graduated in 2002, 2001, or 2000, while 30% graduated in the years 1992 or 1993, and the rest were evenly spread between. Also, when asked whether they had completed their master's degree in engineering, 51% answered yes.

Aprofessional survey research firm, Abacus A s s o c i a t e s , was selected to write and administer the survey and to report the findings. Aphone survey was used to ensure a more representative sample, and a more accurate recording of responses, than a self-administered questionnaire would provide. The phone survey was also important to ensure that the survey questions were well understood.

Respondents were guided through a list of 20 diff e r e n t academic training categories twice, the first time to rate them for their importance, and the second to rate the quality of training they received from their own undergraduate experience. Ranked highest in the importance of training were Oral Communications, the Ability to Visualize in 3D, the Ability to Produce Conceptual Designs, Basic Physics, Written Communications, and Understanding the Fabrication and Assembly Process. At the opposite end, the traditional engineering courses of Chemistry, Circuits, and Electromagnetism/Physics 2 were ranked lowest. Course work in Finite Element Analysis (FEA), Material Science, and D i fferential Calculus were also rated low on the list.

When guided through the same list of 20 categories to rate the quality of training from their own undergraduate training experience, top rated were Aerodynamics/Fluid Mechanics, Basic Calculus, Basic Physics, Thermodynamics, and D i fferential Calculus. Among the lowest rated were the FEA, Understanding the Fabrication and Assembly Process, Circuits, Chemistry, and Computer Aided Design (CAD).

In summary, only Basic Physics and the Ability to Produce Conceptual Designs shared the same top six with the list of those rated most important. While Oral and Wr i t t e n Communications and the Ability to Visualize in 3D were ranked high in importance, they were medium in the ranks of training quality. Understanding the Fabrication and A s s e m b l y Process was also ranked high in importance, but it ranked second from worst in training quality. And while Diff e r e n t i a l Calculus ranked near the bottom in importance, it ranked high in training quality.

These rankings can be examined even closer in reference to the graduating years of the respondents. While across all the graduating years, both Oral Communication and Visualizing in 3D ranked at the top of importance, both also ranked higher in quality among the more recent graduates. Engineers agree that these skills are vital, and it appears that schools are doing a better job in training students in this in more recent years. Meanwhile, Wr i t i n g ranked lower, both in importance and in quality, in more recent years. This may suggest that the teaching of writing skills has suffered recently, while logically, it's perceived importance in the work place increases in later years.

Many broader questions were also asked. As mentioned e a r l y, when asked whether they would have preferred more practical experience or more advanced theoretical training, 83% responded on the side of more practical experience (59% actually responded "much more practical," 24% responded "somewhat more practical"), and this held regardless of graduation year. In this same vein, respondents were asked to name the one course they believed to be most important in learning the skills required to be a design e n g i n e e r. Nearly all of the responses named engineering department courses, labs, or projects, and half included the word "design" in the course name. When asked how much hands-on practical experience they got in this course, 51% responded "a lot" (for the cohort of more recent graduates, this was 67%) and 36% responded "a little". This strongly suggests that courses important for gaining design engineering skills are also inherently practical in nature.

When respondents were asked if they would have preferred more computer-based coursework, such as in CAD or FEA, or more practical experience like making estimates and solving hardware problems, practical was again favored, by a margin of 14%, and this margin was even h i g h e r, at 25%, for less recent graduates.

When respondents were asked if they had a hobby, as an undergraduate or before, that they believed helped them to develop design engineering skills, 57% responded yes, and their hobby was recorded. Of those hobbies, nearly half were modeling, mostly airplanes. When these modelers were asked how important this hobby was to developing the skills necessary to be a good design engineer, 44% said it was very important and 45% ranked it somewhat important.

When asked if they participated in any extracurricular engineering club, society, or organization that helped them to learn design engineering, 57% responded yes. When those who answered yes were asked how important this organization had been to developing the skills necessary to be a good design engineer, 41% said it was very important and 44% ranked it somewhat important.

F i n a l l y, respondents were asked about internships or other employment during their undergraduate training. When asked, 56% said that they had been strongly encouraged to do an internship, 22% to a lesser extent. For more recent graduates, 74% had been strongly encouraged, 14% to a lesser extent. Similarly, 62% of respondents actually participated in an internship compared to 74% of more recent graduates. Clearly, internships have become more prevalent through the years.

Those who had an internship were asked how important the internship was for developing the skills necessary to be a good design engineer. Just over three-fourths (76%) said very important, while 20% said somewhat important. T h o s e who did *not* do an internship were similarly asked if it *would* have helped them to develop the skills necessary to be a good design engineer. Forty-two percent said it would have been very important and 48% said somewhat important. Incidentally, 58% of these internships were done during summers, and 64% of these continued beyond one s u m m e r. Others were completed concurrent with course work (26%) or during semesters off (16%).

The learning of design engineering skills is strongly perceived to come mostly from practical (as opposed to theoretical) course work. Hobbies, engineering organizations, and internships are all perceived to be extremely beneficial to learning the skills to be a good design engineer. Both aspiring engineering students and engineering universities can learn much from the collective advice offered by these 300 recently graduated design engineers.

For a more complete report of this survey, please visit our Web site: **www.aiaa.org/tc/de/index.html**.