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Experience Versus Education in Forensic Engineering

By Joseph E. Bonadiman, PhD, PE

Abstract

Attorneys need to know if the expert witnesses they select are competent professionals. Two criteria attorneys commonly assess are education and experience. This article puts into perspective the positive and negative aspects of both education and experience when choosing an expert witness, and an example is presented to demonstrate each argument. Although directed toward forensic engineers, this article can be applied to other forensic fields.

Key Words: civil engineering, experience, education, expert witness

Much like the argument for nature versus nurture in determining the outcome of an individual's personality, experience versus education in forensic engineering is a subject of contention when it comes to choosing an expert witness. This article defines education as academic education from study and schooling where bachelor's, master's, and doctorate degrees are earned. Experience is defined as education derived from persistence in an occupation that has resulted in the accumulation of wisdom gained from observation and insight.

So, what is more important, experience or education, when choosing an expert witness? When considering a bridge failure, for instance, is it more beneficial to know the modulus of elasticity of steel and vector dynamics or why a similar bridge failed 10 years ago under similar conditions? Who is informed? Who would go in the right direction in an investigation? Who would provide the most appropriate testimony for the client?

A purely academic expert, one whose accomplishments in a discipline are represented by reports in journals or a doctoral dissertation is, on the surface, a good choice for an expert witness. This expert may be a professor at a university supplementing his or her income with expert work. He or she would be highly familiar with state-of-the-art procedures in the field and would be very competent at conveying this information to an audience like a class, jury, or judge. He or she may appear, and rightly so, highly knowledgeable and capable, but is a Professor Jones on campus equivalent to an Indiana Jones in the field?

The practicing engineer, that professional who keeps a pair of work boots in the back of his sedan and who has hands-on experience with every stage of a project, might at first seem a distant second choice to the gilded aura of the academic expert. This individual would have less experience presenting or discussing complex engineering concepts with anyone except other engineers who already grasp the subject. Technical terms might be difficult for an engineer to convey in a way a layman would understand; on the other hand, it is not impossible to conceive of a practicing engineer as having attained sufficient social qualities that enable him to competently relay complicated information in an understandable way. For example, he may be a principal in an engineering firm where he makes presentations to private and public entities. Regardless of the way he comes about his mixture of qualifications, is that mix enough to make him the best choice for an expert witness?

Maybe one of the first concepts to consider is the professional responsibility of two potential candidates. Experts A and B are sample experts. Expert A is responsible for preparing students for the technical world of professional engineering. He has limited experience with actual production design and, besides some laboratory work, has spent little time in the field. His information is handed out to his students, who accept it as infallible and almost without question. In his class, his word is law. Where a classroom peer review is non-existent, any errors in judgment by Expert A would be unlikely to be noticed by his students.

"Who is informed? Who would go in the right direction in an investigation? Who would provide the most appropriate testimony for the client?"

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Barriers to Forensic Engineering Education

By Leann Long, Editor in Chief

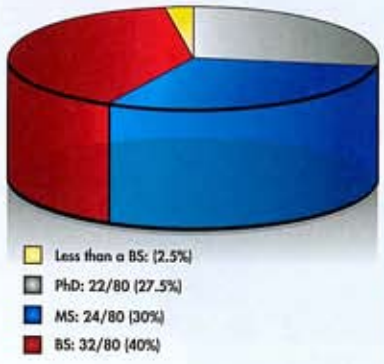
As Dr. Bonadiman mentions in his article, there are not many universities that offer classes in forensic engineering. Failure investigation is an important aspect of the field, so why does this void in engineering education exist? A brief review of scholarship on this subject reveals a complex and multi-faceted issue.

There is no disagreement that forensic engineering courses would be beneficial to include in engineering curriculum. With no experience or instruction on how to solve engineering failures, students are not able to realistically grasp problems that arise in engineering. Exposing students to the implications of engineering failures provides them with an increased awareness of technical, ethical, and professional issues they likely will not otherwise encounter before entering the field (Delatte & Rens, 2002).

Unfortunately, few universities offer such courses, and the ones that do usually reserve them for master's degree programs, making them unavailable to undergraduate students who already have each semester crammed with other engineering classes (Delatte & Rens). Not having adequate or appropriate teaching materials has also been repeatedly given as a reason engineering programs neglect failure analysis courses (Bosela, 1993; Rens et al., 2000). And, many instructors have difficulty adequately planning real-world assignments to fit into one semester (Hanna & Sullivan, 2005).

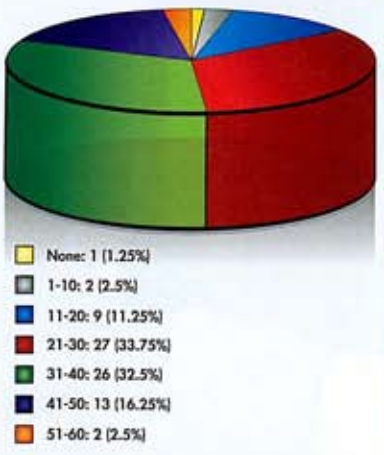
Hiring experienced forensic engineers as instructors would eliminate the assignment-related problems, but such instructors are rare. Typically, forensic engineers are individuals with many years of experience, and of those experts, only the ones with extensive forensic skills and understanding have the practical knowledge to effectively

Highest Engineering Degree



Highest engineering degree achieved as reported by failure analysis expert witnesses registered at jursispro.com. Sample size: 80

Number of Years of Experience



Number of years of experience in the engineering industry as reported by failure analysis expert witnesses registered at jurispro.com. (Only expert witnesses who listed specific companies and dates on their CVs were included.) Sample size: 80

Now consider Expert B. Every day of her life, her hand stamps documents from parcel maps to construction drawings for million dollar projects. Everything she creates is reviewed from top to bottom by other engineers, experienced contractors, municipal agencies, and sometimes even lawyers. Her economic wellbeing, as well as the risk of malpractice suits, constantly looms. It is only through constant vigilance that she is able to keep her doors open. Put a zero in the wrong place and she might lose her license.

Expert B may or may not have a bachelor's degree, usually considered necessary to be a professional engineer, but may have extensive experience instead. Expert A has much more education and, likely, the ability to accomplish a certain level of expertise. Given the chance, undoubtedly he could rapidly gain the experience necessary to become a competent expert witness. In both cases, we still have experience as the basic contributing factor in being a good forensic expert.

The equation of what makes up a good forensic engineer varies. There are variables that can enter an equation and sometimes change it substantially. For example, if Expert A has some of his education in forensic engineering, this may give him a better understanding of legal procedures, investigative methods, and communication skills than may be available to Expert B; with this added "forensic factor" he may have an advantage even if his experience falls somewhat below that of Expert B. However, there are only a few universities offering classes in forensic engineering that will enable the additional "forensic factor." Hopefully, in the future, more academic classes will be readily available to engineers interested in forensics.

An engineer working as an expert witness must be able to recognize his attributes and limitations and honestly portray himself to his or her attorney. This not only allows the attorney to make a proper choice when it comes to choosing an expert, it saves the attorney the embarrassment of a courtroom debacle. A recent civil case highlights the differences in education versus experience. Experts A and B are used again for clarity. Expert B had a bachelor's degree in civil engineering with many years of related experience. Expert A had a PhD in civil engineering with virtually no in-field, design, or supervision experience. The case involved the flooding of a property, the development of several subdivisions of land upstream, and the associated change in the flow patterns of storm water from upstream to downstream. A "10-year" storm event (a storm of such a magnitude of rainfall that it occurs only once every 10 years) took place, the downstream property flooded, and the owner (plaintiff) theorized that it had to have been caused by the new upstream developments. The plaintiff hired an attorney who filed a suit against the upstream property owners and developers, the engineers who designed the subdivisions, and the county that approved the developments.

During the course of the lawsuit, the county was dropped as a litigant, and all but one of the engineers settled. The remaining engineer, facing possible malpractice, would not settle. He felt that not only was he not culpable, but also that he had provided excellent professional services.

The plaintiff secured an expert witness, Expert A. At the time, Expert A was an instructor in hydrology (the earth science of the distribution and quantification of water) and hydraulics (the study of the conveyance of water) in a large, well-respected California university. He had completed his undergraduate and graduate work at the same university. His curriculum vita was impressive, showing expert witness work throughout the western United States. He was a licensed civil engineer and belonged to all of the appropriate engineering and professional societies.

The defense hired Expert B. He was an engineer as well as an engineering contractor and had completed numerous designs and studies relating to hydrology and hydraulics. He was a design principal in his firm where he had designed, constructed, and supervised multiple projects.

teach the subject matter (Delatte & Rens, 2002; Yeung, 2006). Not surprisingly, faculty members rarely meet the requirements to teach forensic engineering courses (Baer, 1996). Madhavan and Malasri (2003) found that a mere 30% of engineering professors in the United States are registered professional engineers. And even being a registered professional engineer is no guarantee that an educator has field experience, as teaching qualifies as practical experience (Yeung).

The dilemma is further complicated by funding problems at the university level. Most universities recruit young faculty members to perform publishable research rather than experienced engineers whose practical knowledge is not always innovative, and therefore, of little value to engineering journals (Yeung, 2006). Compounding the issue, experienced engineers are more likely to have families and financial obligations than fresh doctoral graduates, and industry jobs tend to pay more than university jobs (Yeung). Hopefully the need for such courses will soon overcome the barriers. Readers interested in solutions are encouraged to consult the referenced articles.

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Experts A and B were pitted against each other, and it was Expert A's responsibility to prove that the remaining defendant engineer produced designs and, ultimately, a constructed project that harmed the plaintiff. In order to accomplish this task, Expert A decided a hydrology and hydraulics study and report were necessary. This encompassed visiting the site, gathering topographic data, as well as viewing and recording the drainage patterns and conveyance facilities (culverts, pipes, and catch basins). He would need to contact the local flood control agency to get any information available on the developments/subdivisions, the surrounding properties, and the agency's accepted hydrology and hydraulic procedures. Expert A easily accomplished the first three items but failed to contact or meet with the flood control agency and thereby produced a report that would not have been accepted, much less approved, by said agency. For example, his lack of experience with actual, real-world hydrology and hydraulic reports was evident when he presented the quantities in his report in cubic inches. Civil engineering standards dictate the use of cubic feet, as opposed to cubic inches, in these reports. Secondly, he was unable to correctly define the drainage paths during three separate inspections because he could not accurately locate the contributing areas. Lastly, he conveyed that all the drainage from the upstream developments flowed to the plaintiff's property. This was a gigantic error, owing to the fact that the remaining engineer (Expert B's client) had diverted 40% of the upstream drainage into a separate flood control channel that directed flow away from the plaintiff's property. When Expert A was asked why he did not recognize the diversion, it was discovered that he thought the catch basins (underground concrete structures used to collect water flows) used to divert the flow were used merely to collect and route water around a street intersection.

It was later discovered that Expert A had used graduate students to do much of his work. Here, the lack of experience of the students, multiplied by his inexperience in the matter, proved disastrous for the plaintiff. If Expert A had recognized what was going on, he could have instructed his client to terminate the lawsuit, since there was no culpability by the defendant. The plaintiff lost the lawsuit, and because an offer of settlement had been made, he was forced to pay both the defense attorney's fees and the expert's fees.

One way an attorney can make a proper choice when choosing an expert is to hire a reputable engineer who can evaluate the qualifications of proposed experts and render a decision on their appropriateness. This reputable engineer should not be an expert in the case, for if he were, all of his discussions, observations, recommendations, etc., would be discoverable (discoverable items include work products of an expert witness relative to the case on which he is working, required to be made available to the opposing side). Hiring this engineer may be the most prudently spent dollars on the case. His fees help guarantee that the fees paid to the expert witness will be most profitable.

The importance of education cannot be underestimated. However, an expert witness must have a balance of education and experience. It is the nature of educated people to be nurtured by their experience.

Summary

Substantial experience, with minimum education, will usually win over advanced education with minimum experience. Usually, the best expert is an engineer with practical design experience, construction supervision experience, and management and client relation experience. An engineer with similar experience and advanced degrees will be the preferred witness. An engineer must be able to honestly recognize both his strengths and weaknesses and relate these to his attorney. Many times it is wise for the attorney to select a senior engineer to assist in selecting experts for a case.

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