

ware engineering community in Texas. That does not mean that I do not have concerns about licensing, especially with regard to the specific examination process required in most other states. However, I believe that positive aspects of working with the licensing entities have outweighed the negative ones.

As far as others in the software engineering community (residing in Texas or not) are concerned, everyone should follow their own conscience. For instance, there are those who disagree with licensing in any profession, those who disagree with licensing of software engineers under any circumstances, those who feel that software engineering is not yet mature enough for licensing, and those who disagree with a licensing process for software engineers that involves the FE exam (and does not consider different application domains). Also, it is my impression that only about half of the U.S. states are as restrictive about the use of the term "engineer" as Texas is; this affects how licensing should be addressed. Yet another issue is how a state addresses the "welfare" aspect of the "health, safety and welfare of public" phrase that most engineering licensing laws use: certainly severe financial losses due to software can have an effect on the public.

However, I believe that at some point NCEES will offer licensing examinations for software engineers, and having all stakeholders in the software engineering community involved in the development and maintenance of these exams will be to the benefit of everyone concerned. It is for that reason I hope that professional computing associations like the ACM will someday find a way to be involved with the development of such examinations and of other software engineering licensing criteria. As an ACM member for over 20 years, I plan to do my part by keeping the discussion going in forums such as this. ■

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## A RICE UNIVERSITY PERSPECTIVE ON SOFTWARE ENGINEERING LICENSING

BY KEN KENNEDY AND MOSHE Y. VARDI

**I**N June 1998, the Texas Board of Professional Engineers adopted software engineering as a distinct discipline under which engineering licenses can be issued. The motivation for this decision was the expectation that licensing and the associated regulation of the software engineering profession would lead to substantive improvements in the education of computer software professionals and in the practice of software development in the state of Texas. Four years later, it seems appropriate to reflect on the impact of software engineering licensing in Texas.

In the spirit of full disclosure, we admit we have been skeptical of software engineering licensing from the outset. We are both professors at Rice University with substantial experience teaching courses in soft-

ware development and reliability. From that perspective, the goal of improving education and practice in software development is a laudable one. However, we were worried that licensing might have exactly the opposite of the desired effect. There are several reasons for our concern.

First, it is unclear that licensing software engineers will have any positive impact on the quality of software because most software will continue to be developed by companies. This is particularly true of software that can directly affect public health and safety. In other disciplines, such as civil engineering, individual engineers or small firms provide services directly to government and the public. Thus, licensing serves as a mechanism for certifying that practitioners adhere to the standards of the profession. Most independent software developers, on the other hand, contract directly with corporations, which have the resources to know the difference between profes-

sionals and charlatans. One potential downside of licensing in our view is to limit consulting on software to the holders of licensing. If this were to happen, most of the leading researchers in advanced software development would be precluded from providing sorely needed expertise on leading-edge software strategies to companies in states where licensing is required. This could result in software lower, rather than higher, in quality.

As educators, our principal concern was that licensing would have a strong negative impact on college curricula. Outside of civil engineering, few engineers actually seek licensing. However, we worried that most students would not want to preclude the possibility of licensing at a later date. In Texas, it is extremely difficult to be licensed if you graduate from a department not accredited in the field in which licensing is sought. If schools wish to serve their students, they must seek accreditation for all engineering disciplines in which licensing is available. Thus, the pressure in favor of accreditation could be extremely powerful.

Based on our observation of the impact of accreditation from the Accreditation Board for Engineering and Technology on engineering disciplines at Rice, we believe that accreditation has stifled curricular innovation. This happens because, by submitting to accreditation, the educational institution cedes control of its curriculum to external evaluators who are often committed to standardization rather than innovation. At Rice, a secondary by-product of accreditation has been increasing pressure to require more and more hours in engineering, and consequently fewer hours in disciplines outside science and engineering. As a result, too many of our engineering graduates have difficulty communicating their ideas and are often not as well versed as we'd like them to be in the intellectual, social, political, and ethical issues that define our society. Although there is some evidence that ABET is in the process of reform, the jury is still out on the impact of this reform.

Accreditation in software engineering is particularly problematic because of the impact it might have on the discipline of computer science. One motivation for introducing licensing of software engineering is to offer degree programs entitled "Software Engineering." We have not been impressed by the quality of such programs within Texas and we are frankly skeptical whether the graduates of these programs can ever be better educated in the principles of good software development than computer science graduates from universities of comparable quality. The reason for our skepticism is our view that the software development component of computer science cannot be simply pulled out of the larger discipline and made into an

independent course of study without negative consequences for the students. Good software development must involve an understanding not only of programming practice but also of the theory underlying computer science and the deep ideas in computer architecture and applications. At a time when there is only incomplete agreement on what software engineering should be (the term has been referred to as a "term of aspiration, not of reality") and what might constitute a meaningful software engineering curriculum, we should not be engaging in a process that might inhibit experimentation and innovation in the larger discipline of computer science.

So, after four years, what has been the overall impact of software engineering licensing in Texas? In our view, the news is good: licensing had practically no effect, either positive or negative. We are happy to report that we have not yet seen the harmful effects that we feared earlier. Our students are better attuned with the marketplace than the licensing advocates. In the past four years, not a single student has asked us about licensing or about accreditation. We can continue to introduce curricular innovations and continually improve our curriculum without external interference. Our contacts with graduates who joined various software companies in Texas after leaving Rice confirm that licensing is basically invisible within the software industry here.

Fortunately, this does not mean that software education and practice has stagnated. Universities, both within Texas and nationally, have continued to strive toward improvements in the computer science curriculum focused on software development. We believe that the ACM deserves a great deal of credit for this. By taking a strong stance against licensing four years ago and instead calling for renewed focus on better software development education within computer science (see page 91 for details), the ACM has inhibited a trend that might have taken us down the wrong road in favor of a strategy that can lead to better and more reliable software for the nation.

Finally, we note that licensing *has* had an impact at Rice—we have renamed our course on "software engineering" as "software construction." Hopefully, we will not fall afoul of regulation in the latter industry. **C**

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