

Faculty Opportunities for Engineering Education Program Graduates

Maura Borrego
Virginia Polytechnic Institute and State University

Abstract

Faculty job opportunities are investigated for graduates of new M.S. and Ph.D. programs in Engineering Education. Data sources include positions posted to engineering education listservs over a recent six-month period and an anonymous survey of engineering academic deans. The results suggest that engineering education program graduates will be competitive for a variety of staff and faculty positions in colleges and schools of engineering. However, availability of tenure-track positions will be limited, as a Ph.D. in the discipline is generally required and very few Engineering Education departments currently exist. Despite negative comments about how engineering education graduates will fit into the current university faculty structure, there is support for the new engineering education programs and evidence that graduates will be considered for a variety of positions at four-year institutions.

Introduction

Recent years have seen the emergence of engineering education graduate programs and departments, including those at Purdue University [1], Virginia Tech [2], and the Ph.D. granting partners of the National Center for Engineering and Technology Education (Utah State University, University of Georgia, University of Illinois, and University of Minnesota) [3]. Though applications and informal inquiries attest to the interest in these programs, the question remains as to where (and whether) engineering education graduates will find work. Specifically, the research questions for this study were:

- What types of faculty positions might be available to engineering education program graduates?
- Will engineering education graduates be accepted as competitive applicants for these positions?
- What job market considerations might guide the development of engineering education programs and the advising of engineering education students?

To answer these questions and triangulate the results, two different data sources were used: (1) position vacancies were tracked to estimate the number and type of positions available, while (2) engineering academic deans were surveyed regarding their perceptions of how competitive engineering education graduates might be for these positions.

Method

There were two main sources of data in this study. The first data source was position vacancies posted to two engineering listservs that were not discipline-specific. These lists were monitored from February to August 2005. Most positions were posted to the wepan-l list, which is the announcement email list for WEPAN, Women in Engineering Programs and Advocates

DRAFT © 2005 Maura Borrego

More detail will be provided in "The Higher Education Job Market for M.S. and Ph.D. Engineering Education Program Graduates" in the American Society for Engineering Education 2006 Conference Proceedings.

Network. Any WEPAN member may post to this list. The second was the ASEE Educational Research Methods Division list, to which only the chair can post but this person obliges when requests are made by members to forward relevant, targeted information. The listserv method identified many opportunities not included on the web sites and print versions of ASEE *PRISM* (Classifieds) and the *Chronicle of Higher Education*, presumably because the listservs do not charge a fee and reach a more targeted audience than the *Chronicle*. *PRISM* was also monitored, but provided no additional info.

Second, engineering academic deans were invited to complete a survey of the types of positions at their institutions and the desirability of engineering education graduates for these positions. The types of positions advertised helped to shape this survey's questions. Academic assistant and associate deans were targeted because they typically supervise most of the staff positions included in the survey. The paper version of this survey is included in Appendix B, and Table 1 summarizes the program descriptions made available to survey participants. A web version of the survey was posted using Snap web survey software, and an invitation was sent through the ASEE dean's listserv. Approximately 55 responses were obtained in this manner. Then, at the engineering academic dean's meeting at the 2005 ASEE national conference, the attendee from Virginia Tech distributed paper versions of the survey to collect another 15 responses (to total 70). This person was careful to explain that if the web version of the survey was completed, the paper version was not necessary. A total of 70 responses were received. Assuming that there were no duplicate responses from any single institution, the response rate can be calculated as 20% of the 345 institutions with at least one currently accredited ABET engineering degree program.

Table 1. Summary of the three engineering education graduate programs planned at Virginia Tech, as described in the survey.

Program	Targeted Source of Students	Number of Units	Focus of Coursework	Expected Higher Education Job Opportunities
Certificate	Students earning a Ph.D. in another engineering discipline	12	Pedagogy*	Tenure-track faculty in the Ph.D. discipline
Master's (M.S.) with thesis	Students with a B.S. in engineering	30	Pedagogy, assessment, statistics, and research methods*	Staff positions in administration**
Doctorate (Ph.D.)		37 course, plus research credits	Pedagogy, assessment, statistics, research methods, and proposal writing*	Staff positions in administration**, some faculty appointments

*All programs also include a required teaching practicum.

**Staff positions include opportunities in Assessment, Diversity Programs, Advising, Engineering Teaching Centers, and Curricular Improvement.

Position Posting Results

Table 2 summarizes the positions identified during the sixth-month sampling period, and Table 3 details the faculty positions. Together, they give a general, non-rigorous idea of the number and types of positions that might be available to engineering education graduates interested in higher education work. There is likely a bias toward overrepresentation of diversity positions, since the

DRAFT © 2005 Maura Borrego

More detail will be provided in "The Higher Education Job Market for M.S. and Ph.D. Engineering Education Program Graduates" in the American Society for Engineering Education 2006 Conference Proceedings.

main data source was the listserv for a professional society focusing on women in engineering programs.

Table 2. Summary of Position Postings. More detailed information for each position is provided in Appendix A.

Positions preferring Ph.D. (9 total positions over the sixth-month sample period)	Positions preferring M.S. or B.S. with experience (8 total positions over the sixth-month sample period)
<ul style="list-style-type: none"> • Three faculty positions (two tenure track, one lecturer) • Two research scientist positions • One assessment director position • Three directors of diversity programs 	<ul style="list-style-type: none"> • Five diversity programs staff • One advising position • One assessment position (a professional society's ABET coordinator) • One research coordinator position

Table 3. Detail of Faculty Positions Included in Study.

Position Title	Preferred Education Level	Hiring Institution and Department	Fields (quoted from posting)
Assistant or Associate professor, STEM education research	Ph.D.	South Dakota School of Mines, First Year Experience	Backgrounds in all areas of engineering and science will be considered
Associate Professor, Engineering Education*	Ph.D.	Arizona State University, Ira A. Fulton School of Engineering	Earned doctorate in engineering or closely related field
Lecturer	Ph.D.	University of Toronto, Faculty of Applied Science and Engineering	Bachelor's degree in a science or engineering discipline and a master's or doctorate degree in a relevant educational field

The source for all postings was the wepan-l listserv, except *ASEE ERM listserv & *PRISM*.

All positions are specific to engineering, and those that specified a disciplinary background indicated either engineering, education, or either type of degree. The lecturer position, for example, specified an undergraduate degree in engineering and a doctorate in an education field. As a group, the postings list faculty, research, assessment, diversity programs, and advising positions. The dean's survey was shaped by these preliminary findings, and it asked the deans to rate the desirability of engineering education graduates for these types of positions.

Survey Results: Certificate Program

The 12-unit certificate program was intended to be an additional credential for Ph.D. candidates in other engineering disciplines interested in tenure-track faculty positions. Therefore, this section's survey questions focused on desirability of faculty candidates with traditional engineering degrees and a certificate in engineering education. The responses to this question are summarized in Table 4. Over 67% of respondents would find the candidates very desirable or somewhat desirable; however, 33% of deans appear to have indicated that the additional credential would make no difference.

There was no open response question dedicated to the certificate program, but many deans chose to comment on this issue in the final survey question. A few made it clear that the certificate would be viewed as a secondary qualification to demonstrated research skill. One respondent summarized this view by writing:

DRAFT © 2005 Maura Borrego

More detail will be provided in "The Higher Education Job Market for M.S. and Ph.D. Engineering Education Program Graduates" in the American Society for Engineering Education 2006 Conference Proceedings.

Having a Ph.D. student take courses in teaching is an excellent idea if they are interested in an academic career. However, when recruiting for faculty positions, their potential for a successful research program is very important and the teaching experience would be frosting on the cake (not the cake).

Given two candidates with a similar research record, the certificate candidate would probably be more desirable. However, the certificate should not be pursued at the expense of research skill development.

Table 4. Desirability of engineering education certificate graduates with a Ph.D. in the discipline for tenure-track faculty positions. “Don’t know” was a fourth option, receiving zero responses.

Response	Percentage of Responses
Very desirable, a likely finalist	16% (11 responses)
Somewhat desirable, a possible finalist	51% (36 responses)
Neutral opinion, it would not matter	33% (23 responses)

Survey Results: M.S. and Ph.D. Graduates in Faculty Positions

Perhaps the survey results of broadest interest are those related to faculty positions. This was certainly the interest of the respondents. Of 112 total comments obtained from the three open response questions, 37% addressed faculty hiring exclusively. Another 10% addressed faculty hiring issues in addition to other topics. Likewise, potential engineering education students are very interested in faculty positions. Of potential students responding to Virginia Tech’s open web survey, 47% expressed interest in teaching at the college or university level.

The results of the dean’s survey indicating desirability of engineering education graduates for faculty positions are listed in Table 5. Comments in the open-ended response items and in other areas of the paper surveys indicate that the “neutral opinion” and “don’t know” categories were used differently by various respondents. A negative option was not available, so two respondents wrote “impossible” and “would not consider” in the space provided to check the response for tenure-track faculty positions for Ph.D. graduates. For this reason, it is better to consider the results in aggregate; between 33 and 51% of deans consider advanced degrees in engineering education as desirable credentials for various university-level faculty positions. This is in sharp contrast to the responses for staff positions discussed above, which average 68% and are as high as 80%.

Table 5. Desirability of engineering education M.S. and Ph.D. graduates for faculty positions. Number of responses is included in parentheses. The cells of each row, beyond the double line, should sum to 100%.

Engineering Education Degree	Type of Faculty Position	Combined Desirable*	Very Desirable	Somewhat Desirable	Neutral Opinion	Don’t Know
M.S.	Non tenure-track teaching	43% (30)	16% (11)	27% (19)	44% (31)	10% (7)
Ph.D.	Non tenure-track teaching	51% (43)	27% (19)	24% (24)	26% (18)	11% (8)
Ph.D.	Tenure-track	33% (23)	14% (10)	19% (13)	47% (33)	16% (11)

*Combined desirable = very desirable + somewhat desirable

Many deans simply did not see engineering education graduates fitting into engineering schools and colleges without departments of engineering education:

Engineering pedagogy is a real need. I am not sure that the disciplines are ready to accept people who are trained in this without a credible dissertation in a traditional engineering discipline. Discipline specific expertise is essential to the survival of faculty in research and institutions who are expanding their research capability.

Engineering education is a very dear issue for me. I do not see this as an area of specialization for faculty. It would make a good adjunct to a traditional discipline specific research degree. This is the reality of the current climate, and it doesn't appear to be changing rapidly.

We are a research I university. We have hired one faculty member on an engr ed track. He has a PhD in MechE and training (and desire!) in education. We are WAY more likely to hire in this way rather than a PhD in education and a BS in a discipline. In any case, this candidate will be judged on the same criteria as others - scholarship, teaching, and service.

The number of positions well suited for these people is likely to be rather limited --- but, they can bring considerable strengths to some positions. For the PhD, a stronger scenario is to require an engineering disciplinary MS as part of the program -- then, they may find a wider range of possible teaching opportunities.

There is some evidence that even at the Ph.D. level, an engineering education degree is perceived as shoring up only the teaching skills for a faculty candidate, with no attention to research. (It should be noted that the survey itself reinforces this perception, e.g. by describing each degree with “pedagogy” as the first term, and “research” as one of the last.)

PhD usually means a research track. Other emphasis could be viewed as a distraction. T&P committees would not care about this.

With the tenure-track focus on research these folks might be at a disadvantage.

A person who is interested in undergraduate studies and teaching is most likely to be a successful candidate for this program. The problem is that most of the rewarding system (tenure & promotion) is not based on this type of activities.

Teaching is primary at our institution, but research is equally important in the present climate, and tenure and promotion will weigh heavily on both teaching and research factors.

We would like faculty in addition to teaching engage in research to get research grants, publish papers and guide students.

Some deans did view engineering education as a potential research focus, but one not likely to be supported at their institutions:

Probably would have difficulty in tenure track position, unless they were successful in attracting funding and publishing. Not clear if doing this in the area of engineering education would be sufficient.

Tenure track faculty in engineering will require a research orientation to be successful in institutions that are research oriented. A limited number of positions will be available for pedagogical research. Unless funding is increased in this area little attention will be paid to these types of faculty candidates.

It would be very desirable for tenure track faculty in an Engineering Education degree program to have a PhD in Engineering Education. For tenure track faculty in all other curricula, it is necessary to do engineering research and hence should have a PhD in discipline.

A few deans responded positively that for teaching positions, an engineering education degree would be desirable. However, there was concern over a lack of engineering depth among candidates with a B.S. degree in engineering and a graduate degree in engineering education.

DRAFT © 2005 Maura Borrego

More detail will be provided in “The Higher Education Job Market for M.S. and Ph.D. Engineering Education Program Graduates” in the American Society for Engineering Education 2006 Conference Proceedings.

Lack of depth in subject matter. The candidate would have had depth in engineering typically at undergraduate level, may be slightly higher. Such as candidate may be acceptable at very low level courses (100 level) but understanding of subject matter is highly desirable to teach upper level courses.

For positions in the classroom, there may be problems with the technical depth required to teach the engineering curricular courses.

For teaching positions, would need strong background in the particular discipline. Exception would be "freshman engineering" or other general programs.

One respondent pointed out repeatedly that engineering education graduates would be uniquely qualified to teach freshman engineering courses, while another cited an ABET requirement for instructors which this person thought would be violated by not having an advanced degree in the engineering discipline being taught.

For each of the open response questions, there were consistently 2-3 responses from a handful of deans who did not see a need for engineering education programs and degrees. Some respondents thought the important skills could be learned independently of coursework:

We are quite happy with the faculty we have, who have no training in the areas you cover. Our junior faculty receive mentoring in teaching from senior faculty and this has proven very excellent. Non-tenure track faculty receive the same mentoring. It could be argued that we wouldn't need this mentoring for someone who already had this credential.

There is useful information out there related to engineering education but I am not sure that formal training is the way to go. Motivated faculty with an interest can usually learn and practice. It's the environment that is the main impediment.

And in their final thoughts:

It is NOT clear why you are considering doing this. The opportunities seem rather limited.

It seems that this is an effort to emulate the activities of the College of Education by an Engineering College. We know how the Colleges of Education have failed to meet the challenges of K-12 education in the USA. The USA is far below world standards in K-12 education, however Engineering Education in the USA is the world standard.

Some of the same deans who stated in earlier portions of the survey that engineering education graduates would never find tenure-track positions in traditional departments ended their surveys with positive, supportive thoughts:

I would really like to see more details on the coursework -- course summaries, who teaches them, who administers the certificate program, etc. Personally, it seems to be an excellent and needed program!

Keep working to change the paradigm about the importance of teaching.

I like this idea - Good Luck!

Summary

Two independent data sources were used to evaluate the potential higher education job market for future engineering education graduates. A sample of position listings revealed opportunities in faculty, research, assessment, diversity programs, and advising, many of which specified either an engineering or education background. Seventeen positions were identified during a randomly selected six-month sampling period. Seventy engineering academic deans were also surveyed regarding the desirability of engineering education graduates for faculty and staff positions at their institutions. These results were markedly less optimistic than the position postings. Most respondents indicated some desirability for all the position types included in the

DRAFT © 2005 Maura Borrego

More detail will be provided in "The Higher Education Job Market for M.S. and Ph.D. Engineering Education Program Graduates" in the American Society for Engineering Education 2006 Conference Proceedings.

survey, but they also expressed a wide variety of concerns. Many expressed satisfaction with current employees as well as concern that the engineering education programs described would not sufficiently prepare graduates for the positions. The deans also made it clear that Ph.D.s in engineering education would not be able to find tenure-track positions outside of engineering education departments. Other comments indicated support for the new engineering education programs, but widespread recognition of the unique contributions of engineering education graduates to higher education may have to come later.

Acknowledgements

The engineering academic dean's survey would not have been successful without the help of Dwight Wardell in emailing the invitation, Bevlee Watford for distributing paper versions of the survey, Robert Knee for posting the web survey and summarizing its results, and John Muffo for survey resources and expertise.

References

- [1] Katehi, L., K. Banks, H. Diefes-Dux, D. Follman, J. Gaunt, K. Haghighi, P. Imbrie, R. Montgomery, W. Oakes, and P. Wankat, "Development of graduate programs in engineering education," *American Society for Engineering Education Annual Conference*, Salt Lake City, UT. 2004.
- [2] Griffin, Jr., O. H., A. Aning, V. K. Lohani, J. M. Kampe, R. Goff, M. Paretto, M. Alley, J. Lo, J. Terpenney, T. Walker, H. Aref, S. Magliaro, and M. Sanders, "Designing and Implementing Graduate Programs in Engineering Education," *American Society for Engineering Education Annual Conference*, Salt Lake City, UT. 2004.
- [3] Becker, K., C. Hailey, and M. Thomas, "Work in Progress—National Center for Engineering and Technology Education," *Frontiers in Education Conference*, Savannah, GA. 2004.