Prospective Professors in Training: A Transition Program for Ph.D. Candidates in Engineering

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Professor Allen’s area of research interest is in environmental bioprocess engineering, with particular application to the treatment of aqueous and gaseous emissions and adding value to wastes by utilizing them for the production of energy, materials and chemicals. He has over 100 refereed publications and has supervised more than 20 doctoral students, over 30 research masters and 12 postdoctoral fellows. He was named teacher of the year in 2007 and the ASEE spread the word campus award with Prof Susan McCahan in 2010.

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PROSPECTIVE PROFESSORS IN TRAINING:  
A TRANSITION PROGRAM FOR Ph.D. CANDIDATES IN 
ENGINEERING 

Abstract 
For the past six years, the University of Toronto has been offering a training program for senior-year Ph.D. Candidates in Engineering as they prepare for life after graduation. Specifically, the Prospective Professors in Training (PPIT) Program offers a year-long curriculum that includes seminars, activities and a theoretical course aimed to promote teaching and research excellence for individuals seeking to become engineering educators. For the seminar component of PPIT, students interact with current professors and experts from a variety of engineering disciplines on topics pertaining to: the interview process, acquiring funding, developing a research program, building a research team, the tenure process, and other topics. For the course component, the students examine the fundamentals of engineering teaching in terms of theory and practice for a period of 12-weeks. The course introduces elements of learning theories, engineering pedagogy and accessible instruction, and challenges students to develop a teaching philosophy and an academic dossier - both of which are reviewed by current faculty with constructive feedback provided to the students. 

The study examines the PPIT program over a six-year period and attempts to understand areas of strengths and potential improvement. This paper introduces the PPIT program and its importance to student development, to understand the impact of the PPIT program on the professional development of the students. Specifically, each student was asked to complete a questionnaire before and after the PPIT program and we investigate this information for the purposes of improving PPIT and similar courses at other institutions. As we develop the course for next year, this study provides a framework that can assist in the development and improvement of similar programs in other institutions going forward. 

INTRODUCTION 

The University of Toronto currently has a program for Ph.D. candidates in engineering to learn about the transition from doctoral studies to academic careers after graduation. The objective is to provide students with an introduction to starting and maintaining a successful academic career as new engineering educators. The Prospective Professors in Training (PPIT) program is a constantly evolving program comprised of 12 seminars and a non-credit course which discuss issues from interviewing, acquiring research funding, to teaching in the classroom, among other topics. The seminars are hosted by a variety of individuals, including recently-tenured faculty, the dean of engineering, and the provost of the university. These seminars often include personal narratives that result in greater discussion on a breadth of topics relating to graduate education, acquiring a job, and the transition therein. The course component of PPIT aims to improve the
teaching qualities of each student by providing theoretical and practical instruction on teaching in the classroom. In class, students are introduced to learning theories, literature in the field, learning styles, syllabus development, and others. The emphasis in this environment is on the delivery and not particularly the technical content of an engineering professor’s instruction. This component scaffolds the development of personal teaching philosophies and learning objectives, and gives each student a video-recorded microteaching sample for feedback purposes. The successful completion of both aspects of the PPIT program then concludes with a teaching dossier project, after which each student is awarded a certificate of completion and a notation on their official academic transcript.

There are currently 115 alumni of the PPIT program, as a result of its 6 year history. The program began in 2006 as a pilot program with 20 participants following an initiative by three engineering professors at the University of Toronto. An initial evaluation resulted in encouraging feedback that prompted the establishment of PPIT as an official Faculty-sponsored program in 2007, with an average enrolment of 25 participants per year depending on number of eligible applications. While the program was originally directed at Ph.D. candidates, postdoctoral fellows were accepted into the program on many occasions as well.

This paper examines the PPIT program over a six years period since its inception. In doing so, it presents some of the strengths of this program, opportunities and potential areas of improvement. The content of each of the seminars is analyzed to provide insight into how the theoretical concepts were received by program participants. These analyses compare the perceptions of the course longitudinally in an attempt to understand the impact of the PPIT program on the professional development of the participants. Each participant was asked to complete a questionnaire before the program which provided an overview of the expectations of students and their view of teaching and the academic career before starting this program. Furthermore, we have gathered a dataset that includes information on how the program has evolved over time through seminar content and post-program feedback from participants. Following an outline of the methodology below, the discussion analyzes quantitative data provided by student feedback. Such feedback, in addition to open-ended comments received from students, is collectively used to improve the course each year. Based on this feedback, some seminars were added to better serve the interests of the program’s participants. As we develop the course for next year, this study informs a framework that can assist in the development and improvement of similar programs in other institutions going forward.

PROGRAMS AT OTHER UNIVERSITIES

The PPIT program shares its objectives and activities with a number of other programs within the University of Toronto and at other institutions, however it is also unique in a number of ways. Especially through its focus on engineering disciplines and the community, it develops
Within the University of Toronto, there are three programs that are directed at improving the teaching ability of graduate students. Teaching in Higher Education (XX500) is a course offered by XX College. The aim of this course is to support senior Ph.D. candidates and postdoctoral fellows in improving their teaching over a series of sessions taken in one semester. Similarly, the Teaching Assistants Training Program (TATP), offered by the Centre for XX at the same university is open to all graduate students at the institution, irrespective of degree or current employment status. This program focused towards those that are teaching assistants or first-time course instructors at the university, and have regular interaction with students. Here, the goal is to improve the delivery of course content by focusing on the presentation and composition of a tutorial for students. The TATP program’s objective is to help TA’s become better instructors, and this program also fulfils union requirements for new employee training as well. It focuses instruction to a general population of TA’s and instructors and does not focus on technical or professional education per se. There are also several programs at other universities whose goal it is to improve the teaching qualities of their instructors. However, these programs do not specifically tailor their instruction towards combining three elements together, namely; providing instruction on how to become a better instructor, highlighting activities in an academic job search process, discussing how to set-up and maintain an engineering research lab. In addition, they do not necessarily encourage discussion of personal narratives between students and the various seminar speakers that are like those in the PPIT program. As a result of this unique experience, the PPIT program should be examined to see whether the content and delivery of the program has a positive experience for the participants over the years.

Several colleges and universities have training programs for teaching assistants that promote a higher quality learning environment for students. Though there is much variation in the composition of these programs, the general objectives are similar to PPIT’s teaching component. Specifically, Norris and Palmer describe a doctoral teaching intern program for engineering students at Georgia Institute of Technology. They adopt a team-teach approach between a faculty member and doctoral student, and pay students for conducting one to two-thirds of their course for the quarter while the instructor is present for at least half of them. Wankat and Oreovicz clarify the need for instructional programs for Ph.D. candidates specifically, provide a framework for successful programs, and describe the value of such programs at several universities. Such programs also exist in doctoral programs outside of engineering. Utect and Tullous describe the context and approaches used in business schools and their literature can be used to draw connections between engineering and other areas of higher education.
Brent’s work in this area discusses the program at North Carolina State University with ratings and critique for each of the areas of teaching they focus on. Velasquez describes a similar program but in the context of online learning at Purdue University.

**METHODOLOGY**

The PPIT program is divided into a number of components that allow its participants to engage in learning and reflection activities about learning theories and instructional practices. The program includes a series of 12 seminars in addition to a course on teaching that runs alongside the seminars for one term. This section outlines this course structure as well as other elements of the course including evaluation, student feedback and web support.

**Application to the PPIT program**

The application process provides a screen process for instructors to understand student learning priorities as well as resolve logistical matters. More importantly, the application form encourages the program’s participants to reflect on what they want from the program and their ideas on teaching and the academic career before enrolling in the program. This reflection, in the form of responses to two short-answer open-ended questions, also provides the course coordinators with useful benchmarking information when needed. Specifically, the reflection is used to help each student gauge their own interest in pursuing 12 seminars and enrolling in a not-for-credit course on teaching.

**Seminar Series**

This series consists of 12 seminars that occur over a period of eight months. The seminars are around two hours in length and host engineering professors and administrative staff who speak to the students, share their experiences and engage in an open discussion. The seminar speakers often come prepared with a slideshow and presentation of about 30 minutes, followed by a discussion that occupies the remainder of the 2 hour time slot. The seminar component of PPIT is bookended by panel discussions between 3-4 engineering professors of varying years of service in either teaching or research capacity to the university and of different engineering disciplines. In recent years, there have been a mix of teaching-stream as well as research-stream tenure track professors that have participated. The introductory panel of PPIT is usually focused by instructors discussing their progression from graduate school to a pre-tenure faculty position. The last panel of PPIT, which is held after the teaching course has also completed, often includes a different set of discussion points - ones that reflect the progression of students as they have gone through the teaching component of the PPIT program.

Each seminar is themed to a particular topic. The complete list of topics covered over the years is included in table 1.0.
<table>
<thead>
<tr>
<th>Seminar/Workshop Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>Introductory Panel Discussion: Being a Professor in Engineering</td>
<td>An open discussion with 3-4 professors about the academic career in an engineering department</td>
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<tr>
<td>Preparing your CV and Applying for Academic Positions</td>
<td>Elements of the CV and cover letter, and the application screening process</td>
</tr>
<tr>
<td>The Teaching Dossier</td>
<td>Components of the teaching dossier and methods of collecting documentation</td>
</tr>
<tr>
<td>The Academic Work Search</td>
<td>Searching for academic positions through departmental announcements, specialized magazines, and networking</td>
</tr>
<tr>
<td>The Academic Interview and Negotiating the Job Offer</td>
<td>The process once a candidate has been shortlisted for a position including the interview, graduate and undergraduate presentations, and aspects of negotiating the offer beyond compensation</td>
</tr>
<tr>
<td>Starting a Research Program</td>
<td>Applying for research grants, allocating startup funds, hiring your first graduate student, acquiring equipment, and administrative tasks</td>
</tr>
<tr>
<td>Writing Successful Grant and Research Proposals</td>
<td>A look at grants and proposals from the perspective of the evaluation committee</td>
</tr>
<tr>
<td>Managing Time, Money and Students</td>
<td>The administrative aspects of a professor’s job after a research program has been established</td>
</tr>
<tr>
<td>Classroom Management</td>
<td>Tips on running a lecture or lab, communicating effectively in a classroom and dealing with disruptive behaviour</td>
</tr>
<tr>
<td>Managing Collaboration</td>
<td>Collaborating with industrial and academic partners on research, grants and publishing</td>
</tr>
<tr>
<td>Publishing in Academic Journals</td>
<td>Choosing high impact journals, and tips for the submission and review process</td>
</tr>
<tr>
<td>The Accreditation Process</td>
<td>Accreditation requirements, frequency of accreditation reviews and preparing for the review</td>
</tr>
<tr>
<td>Closing Panel Discussion: Being a Professor in Engineering</td>
<td>An open discussion with 3-4 engineering professors that acts as the closing and reflection session for the program</td>
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</table>
Though the seminar themes change slightly over each iteration of the program, often due to instructor availability, content changes based on discussion topics at the time. This allows for a student-centered learning environment where students can direct the content of the talk, and can increase the richness of the experience for the group. These seminars are hosted by faculty as well as staff of the university. In particular, the career centre has delivered several seminars that discuss the academic work search process, and they highlight the mechanics of developing an effective curriculum vitae for academia. In 2013, the facilitators of the PPIT program were able to schedule both the Vice-President and Provost, as well as the Dean of Engineering to co-deliver a seminar. This particular seminar had the added benefit of highlighting the administrative side of academic work from unique perspectives, while understanding the roles of central and faculty-specific university leadership.

**Teaching Course**
The course component of the PPIT program is called, “Engineering Teaching and Learning”, and includes 12 classes of 2-hours each, once a week. The course is pass/fail, not-for-credit but successful completion is required for the PPIT certificate and notation on the transcript. The course is designed for people with an interest in furthering their understanding of curriculum, teaching and learning, and in particular within the context of the engineering education. A general overview of the topics in this course is outlined in figure 1.0 below. Basic concepts in curriculum, teaching and learning, and current research in the field of engineering education are introduced and discussed. The goal is that students should have an understanding of the important models, ideas, and literature that currently inform the practice of teaching in engineering and science at the university level. Using this knowledge, all participants create a portfolio that showcases elements of course design. Several in-class activities support the development of this portfolio. This course also includes a microteaching component, in which students have the opportunity to develop and teach a short lesson to classmates. Through this, students explore the mechanics of good teaching, common patterns in teaching and the benefits of reflection.

![Fig 1.0 - Shows a general overview of the concepts covered in the course component of PPIT](image-url)
Two elements that are characteristic to the PPIT course outside of traditional lecturing are the teaching portfolio and microteaching activities. Students are asked to incrementally develop a teaching portfolio that contains material for a proposed course. These portfolios include a teaching philosophy, sample syllabi and course material, assessment material, and a discussion of the application of teaching theory to practice. This project occurs while students develop their academic CV and cover letters from the seminar-based aspect of the PPIT program. The intention is for each student to be well on their way in developing a course as they begin their actual academic searches. In addition to these activities, students are expected to deliver a 20-minute microteaching activity in the presence of their peers and course staff. This is essentially a videotaped lecture of each student, pending their approval, where the video is returned to each student for personal self-reflection. Students then write a brief paragraph that critique their pace, body language, volume, and other aspects of presentation. In general, these activities further scaffold the development of each student’s ability to become a better instructor in an academic setting.

**Survey and Feedback**
The survey in its recent form has been conducted twice over the course of the academic year. Feedback from the first term is used to inform planning for the second term and overall feedback is used to evaluate the program and plan following years. The rating scale used in the survey and the open-ended question are shown in [Fig 2.0](#).

1. **Seminar rating**

<table>
<thead>
<tr>
<th>Seminar Title</th>
<th>Never again</th>
<th>Not very useful</th>
<th>Useful</th>
<th>Very useful</th>
<th>Must have again</th>
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2. **Which of the seminars did you like the most and why?**

   

3. **Comments/feedback/suggestions?**

   

![Fig. 2.0 - Shows sample exit-survey questions](#)
Alumni Network
The program’s alumni since 2007 have moved on to pursuing career opportunities mostly as Professors at universities in various countries including Canada, the United States, China, among other international institutions. However, others have decided to pursue careers in industry, in some cases, temporarily before returning to academia. Furthermore, most of the teaching assistants of PPIT are graduates of the program, interested in promoting scholarship through teaching.

DISCUSSION

On average, the completion rate for PPIT has been more than 80% (Table 1) taking into consideration that students can complete the program over a period of two years during which they can satisfy the minimum attendance requirements.

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</thead>
<tbody>
<tr>
<td>Enrolled</td>
<td>22</td>
<td>33</td>
<td>20</td>
<td>17</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Completed</td>
<td>19</td>
<td>26</td>
<td>15</td>
<td>13</td>
<td>24</td>
<td>25</td>
</tr>
</tbody>
</table>

The responses to the survey questions and feedback over the past six years revealed a number of patterns that will be presented here as lessons learned according to our administrative best practices and feedback from the survey.

1. Coupling core requirements with flexible scheduling:
   Students have busy schedules and occasionally engage in other commitments that require absence for a few weeks for research work or conferences. To encourage participation and the completion of the program, students are allowed to complete the program requirements over a period of two years although they are strongly encouraged to complete it within eight months.

2. Identifying the interests of participants:
   Many programs focus on skills that relate to teaching, grant-writing or high-impact publishing as some of the more important skills required to establish a successful academic career. Feedback from students, however, has shown that they place equal importance on the stage between graduation and starting their first position. The uncertainties associated with this stage give rise to questions about the importance of pursuing a postdoctoral fellowship or industry experience and the process of applying for jobs, networking, interviewing for a job and negotiating a job offer. The discussion opening and closing panel discussions with faculty members have proven to provide a
safe environment for program participants to address these aspects of their career development; concerns which can be overlooked in programs that focus on teaching.

3 Addressing information gaps beyond teaching and research:
The surveys and entrance questionnaires revealed that a number of participants had little exposure to the various roles of faculty members beyond teaching, research, supervising students and grant-writing. Other administrative roles such as service on departmental committees, research chair positions and grant review assignments were among other commitments that had to be highlighted. This focus was supported by seminars that provided a discussion of the teaching dossier, accreditation process, and discussion panels that emphasized the importance of other service roles which can occupy 20-40% of a professor’s schedule.

4 Balancing theory and practice:
The surveys have also highlighted a variation in the preferences of program participants in terms of the seminars they found most useful or workshops marked as their favorite. A possible explanation of these differences is the natural diversity in learning styles and objectives from enrolling in the course. However, we also realize that some seminars will have direct application that would serve current or short-term career goals, while other seminars simply offer perspective which develops the necessary background and draws a more comprehensive picture of the engineering academic career. For this reason, the program balances the emphasis on theory and practice as evident in the teaching course, for instance, which complements the teaching experience many of the PhD students already have with the necessary background on the theories of engineering education.

Taking these lessons into account, the course has evolved into its current form with a dynamic portfolio of seminars and a calculated balance between theory and practice. Nevertheless, we have also been looking lately at ways of improving the program. One aspect we are presently considering is tapping our network of alumni as a valuable resource. Many of our alumni have established successful research programs in their respective institutions and they can play a significant role in this program. We hope to keep these alumni connected beyond the program through professional social networking. We also plan to use their experience as guidance for current program participants through a mentorship program that would match professors and alumni with the students of the program.

Our assessment of the program also has some limitations. One such limitation is that the survey and this research relied on anonymous feedback with no respondent information. Thus, did not distinguish between students who are pursuing a research-stream faculty position versus those who are pursuing a teaching-stream faculty position. Despite the assumption that many of the program’s participants will be joining institutions that focus on research, feedback from the
The PPIT program is unique in that it combines instruction on teaching, academic job searching as well as research program development. This approach is different than ones offered at most other institutions because the focus is on the transition from Ph.D. candidate in engineering to prospective professor with strong teaching skills and a research program. Though the instruction on becoming a better teacher focuses on key areas of development, it is not able to discuss all aspects of teaching in particular detail. In particular, the current PPIT program does not discuss online learning or mentorship, or other kinds of instructional experiences that may occur in academia. Further, the seminar component of the program relies on the speaker to provide the material, and this may cause inconsistency in learning across years. However, this inconsistency does provide for flexibility in programming choices in selection of speakers. Since each speaker in the PPIT program is a volunteer, it shows the students the commitment of the university to the success of each participant. This year, having both the Dean of engineering and Provost of the university deliver a seminar together is an example of this type of flexibility, and how multiple areas of academia can come together to help prospective professors in training.

CONCLUSION

The PPIT program is currently in its sixth year and has been evolving since its inception. This change is driven by feedback from the program’s participants in addition to the dynamic nature of the market for academic careers. This paper presented the structure of this program including its various constituents in the form of the application process, seminar series and teaching course. Another important element showcased in this paper was the methods used for evaluating the program including the entrance questionnaire and the term survey. Feedback from these surveys has become a pivotal component of planning the course in addition to the initial vision. The program’s participants have the option of completing the attendance requirements over a period of 24 months, taking their various other commitments into account, although they are encouraged to complete the program in eight months. The seminar series are book-ended using panel discussions with engineering professors at various stages of their career. These discussion panels provide the participants with an opportunity to reflect on their goals in the beginning and what they have learned in the seminars through an open discussion with assistant as well as more established engineering professors.
ACKNOWLEDGMENT
The authors would like to thank Estina Boddie for initial logistical support, and for their collaboration with former teaching assistants who have helped run the program in past years and maintained reports on seminar topics, student feedback, and performance.

BIBLIOGRAPHY


