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The Rising Engineering Education Faculty Experience (REEFE): Preparing Junior Colleagues

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Abstract

Despite the importance of professional development, for most graduate students as up-and-coming faculty members professional development is informal at best. Graduate programs often emphasize gaining technical knowledge, skills, and abilities through courses and research projects, but provide less opportunity for future faculty members to gain experience with teaching, service, communication, assessment, proposal writing, etc. To provide this experience, we developed the Rising Engineering Education Faculty Experience (REEFE). Founded on theoretical and practical models of graduate student development, REEFE is an innovative faculty apprenticeship program for engineering education graduate students that places students in visiting faculty member positions at host schools. This paper describes the foundations of REEFE and the program itself. We also offer lessons learned from the host school, sending school, and participants based on prior REEFE implementations. We hope our learnings prompt discussions regarding how to effectively prepare future engineering education faculty.

Introduction

Faculty members and the future faculty they train (i.e., graduate students, post-docs, and new PhDs), represent the lifeblood of academic institutions. Moreover, through teaching, research, and service activities, faculty members make a critical societal and economic impact both locally and nationally. Despite the importance of this professional calling, professional development for most up-and-coming faculty members is informal at best. Graduate programs often emphasize gaining technical knowledge, skills, and abilities (KSAs) through courses and research projects, but provide less opportunity for future faculty members to gain the KSAs needed for teaching, service, communication, assessment, proposal writing, collaboration, etc. Some fortunate graduate students have advisors that serve the dual role of both doctoral advisor and professional development mentor, while other graduate students find mentors beyond their formal advisor to supplement their professional development needs. However, these scenarios are often more the exception than the rule and many graduate students could benefit from additional professional development opportunities.

To address this graduate student need, we developed the Rising Engineering Education Faculty Experience (REEFE), an innovative faculty apprenticeship program for engineering education graduate students. The program is founded on models of graduate student development (i.e., Nyquist and Wulff, King and Kitchner, Kram, and Baxter Magolda) and places engineering education graduate students in visiting faculty member positions at host schools. REEFE offers students the ability to gain experience as a faculty member, connect with a new community of practice, and develop significant mentoring relationships, all while developing the professional KSAs needed to succeed as a faculty member. As a means to support engineering education graduate student development more broadly, this paper will describe the theoretical foundations of REEFE, provide a full description of the program, and discuss our learning after implementing the program for two full implementation cycles. It is our expectation that by presenting and

publishing on REEFE we can not only increase the number and quality of graduate student professional development opportunities, but also encourage the larger discussion of how to effectively prepare future engineering education faculty.

Background & Benefits: Framing the Rising Engineering Education Faculty Experience

The Rising Engineering Education Faculty Experience (REEFE) is an apprenticeship/partnership program between Virginia Tech's Department of Engineering Education and the Rose-Hulman Institute of Technology (RHIT) that provides graduate students in engineering education an opportunity to connect and collaborate with practicing engineering educators. We believe that the REEFE experience not only enhances engineering education graduate students' professional development, but also enhances the engineering education research-practice cycle[1]. To this end, the program is intended to provide graduate student participants the chance to utilize their engineering education expertise while experiencing the day-to-day activities associated with being a faculty member. The program also encourages existing faculty members to build their expertise in the discipline of engineering education. Modeled loosely on the Preparing Future Faculty initiative[2], the REEFE experience is informed by numerous academic stage models popular within educational contexts[(i.e., 3,4,5)]. (Note: These stage models were outlined in a previous paper[6] that explored the professional development experiences of the first students to participate in our program.)

The objectives of the program center on two key participant groups: graduate students and practicing engineering faculty. For graduate students, the REEFE experience is designed to meet several major areas of professional development. First, the students are given access to the world of faculty life. This access includes attending departmental and college-level committee meetings, attending faculty social and academic functions, and being provided the freedom to work independently on projects of interest. Importantly, students are able to work side-by-side with experienced engineering education professionals, helping to make students' theoretical education more practical. Second, each student is challenged to use their unique set of knowledge, skills, and abilities (KSAs) to serve the host institution manifesting into a project or set of tasks based on these KSAs. As a result, the REEFE experience is uniquely personal and designed to meet the needs and goals of both the student and the host institution. Third, the student is provided with an opportunity to work in a separate environment from their typical graduate student cohort. This independence is intended to help the student grow in confidence and assurance regarding their own expertise.

While the students gain valuable professional experience during the REEFE program, the host institution also receives several benefits. First, faculty at the host institution are provided the opportunity to gain formal knowledge in engineering education theory, methods, and research through workshops, one-on-one meetings, and casual interactions with the engineering education doctoral students. Although many institutions have experienced engineering educators interested in formal engineering education theory, methods, and research, often, these faculty do not have formal training in or access to engineering education methodologies (e.g., many practicing engineering educators were educated and trained in their technical disciplines). We believe that the opportunity to interact and collaborate with formally trained doctoral students gives

practicing engineering educators valuable and efficient resources to develop their skills and run educational research projects. Second, the host institution can recruit a student with a skill set that is currently lacking at the institution. For example, if an institution is striving to develop online learning opportunities for its students, a student with experience in online engineering education environments can add a missing, but needed, skill set at the institution.

Past Implementations of REEFE

As of June 2015, two cohorts of two students each have participated in the program, with all four students being full-time graduate students in the Engineering Education doctoral program at Virginia Tech (VT). The participating students (hereafter, "students") were selected and placed based on the expertise (KSAs) they could contribute, as well as their research or teaching interests. A requirement of the program was that students be in the later stages of their degree programs, preferably having completed all requirements but their dissertation. Students were officially listed as "part-time visiting faculty members" with the understanding that a 20 hour/week commitment toward host institution projects was expected. As such, students received a stipend approximately equal to their graduate student stipend, with half of the stipend being provided by the host institution (RHIT) and half of the stipend being provided by the home institution (VT). Once placed at RHIT, students were given dedicated office space and institutional access to all resources typically granted to faculty. They were also strongly encouraged to participate in the professional life of the institution in various ways (e.g., participating in the new faculty activities, attending faculty meetings, eating in the faculty/staff dining room, attending Homecoming, etc.).

It was important that students' progress to degree completion was not significantly impacted; therefore, students continued to work on their dissertations, maintained contact with their research groups, and otherwise sustained their participation in graduate program activities as geography and available time permitted. Students maintained their student status at the home institution in order to retain health insurance, institutional access to resources, and continuity within their graduate school cohort and program. For the two cohorts that have been through the program, participation began in the fall semester to allow a relatively seamless integration between Virginia Tech's semester schedule and RHIT's trimester schedule. Importantly, this timing also allowed the students to enter the host institution in a manner consistent with that of other new faculty (e.g., attending new faculty training), experience the positive energy accompanying the new academic year, and stay aligned with the academic calendar at their home institution.

Although originally conceived as a teaching-focused experience, the needs of both the participating students and RHIT demanded a change in perspective before the first cohort of students was accepted. The experience transitioned from a teaching-focused experience to a "needs or best fit" experience. This switch aligned students' potential contributions (KSAs) and professional development needs with a set of activities that provided value to RHIT. In both cohorts to date, one student has worked as a member of RHIT's Institutional Research, Planning, and Assessment (IRPA) Office and the other worked as a member of the Center for the Practice and Scholarship of Education (CPSE). For the IRPA placement, the funding was provided through grant support, while for the CPSE placement, funding was secured through multiple

internal sources (e.g., collaboration with other programs). As mentioned previously, the four students all participated in meaningfully different projects (detailed in Table 1). In each case, the student had contact with faculty, staff, members of the upper administration, and undergraduate students at RHIT.

Host Office	Student	Project	Participating Offices	Student Background	Products
Table 1: *Participation details for each REEFE student through two cohorts.*					
Institutional Research, Planning, and Assessment (IRPA)	Student A Cohort 1	Development of entrepreneurship education grant proposal including assessment component	Engineering Management, Making Academic Change Happen	Industrial Engineering, Engineering Management, Entrepreneurship	Literature review, bibliography, proposal writing
	Student A Cohort 2	Assessment of entrepreneurship education initiative	Engineering Management, Dean of Innovation, Rose Innovative Student Entrepreneurs	Electrical Engineering	Assessment of co-curricular entrepreneurship education activities, development of entrepreneurship evaluation rubric
Center for the Practice and Scholarship of Education (CPSE)	Student B Cohort 1	Consulting with faculty on research design and implementation	Multiple Academic Departments	Mechanical Engineering	Bibliographies, faculty research plans, collaborative presentations
	Student B Cohort 2	Enhancement of institutional diversity programs	Center for Diversity, Rose Building Undergraduate Diversity	Electrical Engineering	Teaching workshop, program assessment, NSBE mentoring

Considerations After Two Full Implementation Cycles

The following sections are written using different, more specific "voices" as the best individuals to share meaningful perspectives are participating members of past REEFE implementations.

Considerations from the Host Institution: An RHIT Perspective
(written by: Dr. Julia Williams – RHIT Faculty & Executive Director of IRPA)

Participation in the REEFE program provided the IRPA office with expertise in engineering education that was not previously part of our repertoire. The IRPA office serves the faculty, staff, and students of RHIT by providing a variety of services, including assessment and evaluation services for faculty who wish to use engineering education research as the basis for course improvement, pedagogical research, and grant preparation. The expertise of the REEFE students

has been significant because they have been able to contribute in all three areas within the context of the entrepreneurship education initiative that has been underway since 2012. Responding to an external funding source, members of the faculty and administration began in 2012 to develop a vision for entrepreneurship education; this vision would necessitate the development of new courses and new strategies to assess the impact of those courses on students' entrepreneurial-mindedness. In addition, we saw the need for assessment of entrepreneurship outside of the classroom environment, since co-curricular activities provide important sites for the development of students' professional skills such as communication and teamwork.

In the first year of REEFE, the student brought experience in entrepreneurship from his previous graduate teaching and professional development experiences. As an addition to the IRPA office, he functioned as an important resource, since none of the other IRPA staff had experience in this field. The student conducted a thorough literature review of the field of entrepreneurship education assessment, assisted the IRPA staff to become conversant in this area of research, and supported an assessment of a case-study intervention. His support occurred during regular IRPA staff meetings where the student was a respected and equal member of the IRPA team. In addition to developing the literature review and bringing the staff up to speed, the student was asked to collaborate with the writing of a grant proposal; he offered feedback on the assessment plan and identified particular assessment methods and tools that would help us with the project. The successful proposal established the foundation for the work of a REEFE student in the second cohort.

During the second cohort, the new REEFE student working in IRPA was asked to implement two specific dimensions of the entrepreneurship assessment plan. One important assessment tool is a rubric that can be used to assess the entrepreneurship outcome in a variety of courses. The student conducted research into the current state of entrepreneurship rubrics and shared these tools with members of the Institute-wide committee that oversees outcomes assessment. In addition to the course-based assessment, the student assisted with the assessment of entrepreneurship through the RHIT Leadership Academy and served as a member of the Leadership Advancement Program (LAP) team; a team made up of 15 faculty and staff who develop and deploy the LAP programming.

After bringing two REEFE graduate students into the IRPA office, we see clear benefits to our work through this collaboration. As an undergraduate-focused institution, we do not have the resources in terms of expertise that are available in a research-focused setting. Through REEFE, we can leverage outside resources for the benefit of our faculty and students. We see our contribution to the development of future engineering faculty in showing them the demands of an office like ours, since we must quickly move between areas of expertise and even develop new areas to respond to the interests and demands of faculty and the administration. Our hope is that when these students become faculty members, they will see the institutional research office on their campuses as an important resource and potential collaborator.

Considerations from the Sending Institution: A Virginia Tech Perspective
(written by: Dr. Holly Matusovich – VT Faculty & Assistant Dept. Head for Graduate Programs)

After participating in two cohorts of the REEFE program, there are three primary considerations from the Virginia Tech perspective. First, students can continue to make significant degree progress during REEFE because the faculty at both institutions support this effort. As an example of degree progress, two of the students were able to complete and successfully defend their dissertation proposals while living and working at RHIT. To enable such progress, the students, VT advisors, and RHIT mentors discuss goals and objectives from the institutional and student perspectives before the REEFE experience begins. This goal-setting focus ensures that that there is alignment and accountability. Periodic check-ins and on-going, open conversations between all stakeholders support this critical aspect of the REEFE program. Part of the alignment process is being sure that expectations are reasonable and then continuing to check that the student is appropriately balancing degree progress and REEFE program work. We believe that while this experience is important for students to develop professionally, significant distraction from degree progress is detrimental to the goals of our students and our graduate program.

Second, REEFE facilitates a transition from graduate student to faculty perspectives which requires re-integration support at VT once students return to the Blacksburg campus. An important part of the REEFE experience is that it helps the students' development in becoming a faculty member. Essentially, the students function as faculty while at RHIT and interact with colleagues as such. While this development is very positive, it can be challenging for students to return to their home institution where they predominantly act in a graduate student role; for example, a success of the REEFE experience is its ability to help students develop professionally, but the VT faculty at large have not participated in the change process and may not recognize or value the student's growth. To continue to promote the transition from graduate student to faculty, it is necessary for us to openly talk about students' re-integration and determine what support mechanisms are needed by each participating student. In one case, such support included not returning to the VT campus proper but to work from a distance to complete dissertation research.

Finally, there are some purely logistical issues that must be considered. For example, since REEFE is a partial year experience, students often keep their housing at VT and obtain additional housing at RHIT, which essentially means requiring housing in two locations for a semester. Clearly this can create a financial burden that should be considered. The logistics of maintaining health insurance must also be considered as we have already discussed. Additionally, while working at RHIT, students are engaging in activities at VT such as research group meetings or attending seminar. Participating from a distance requires appropriate resources (i.e., hardware, software, internet access, etc.) and time in order to establish and maintain relationships and existing collaborations.

Although perhaps negative sounding, each of these challenges is actually a good challenge to face. It is a sign of the benefit of the program that integration in both the VT and RHIT settings can be achieved simultaneously. The challenges described herein are not insurmountable and in fact seem well worth the effort given the benefit to the student participants.

Considerations from the Student Perspective
(written by: Cory Hixson, current VT student, and Rachel McCord, current Univ. of Tennessee Faculty and former VT student)

We (Cory and Rachel) detailed much of our professional development experience in a prior work[6], but here we will discuss other student considerations related to participating in the REEFE program. In general, participating in the REEFE program is both a valuable and challenging experience. Our hope is to provide interested students with some additional information regarding what it is actually like to participate in the program.

First and foremost, participating is valuable because we were able to meet, collaborate, and develop relationships with outstanding engineering educators and professionals in our field. We still collaborate with many of the individuals we met during our time at RHIT. At a minimum, we see many of them at professional conferences, which increases our sense of belonging in the larger engineering education community.

Student participants also have the opportunity to experience what it is like to be an engineering faculty member. Because of RHIT's success at welcoming us as part-time visiting faculty members and allowing us to participate in the same new faculty experiences as new full-time faculty members, we were treated as actual RHIT faculty about 90% of the time. As with any "new" program or activity that represents "change," our value was at times questioned by program skeptics (e.g., not really being thought of as visiting faculty or having our expertise questioned), but this was very much the exception and not the rule during our time at RHIT. Obtaining this faculty experience is very difficult, if not impossible, within our graduate program, because we are typically introduced and classified as graduate students throughout our time in the doctoral program.

Further, the program is valuable because it allowed us to put the engineering education knowledge we have and are learning into actual practice. We were selected to do work on projects at RHIT, and we were treated as professionals and asked to independently produce results. Despite our specific projects, we were also able to participate in conversations and side projects related to many other aspects of engineering education (e.g., a book club about classroom culture that organically developed). This culture promoted our ability to synthesize and apply what we'd learned in our graduate program.

Finally, the program adds a standout experience to a C.V., adds a level of professionalism and appeal to a job application, and provides great talking points during an interview. Realistically, we all want to graduate and officially become professionals in the field (be it in academia or industry) and this experience not only supports that outcome, but it also supports our success when we become professionals in the field.

Besides being a valuable experience, participation is also challenging in many ways. Students are required to leave their homes, friends, peers, graduate programs, and possibly families which removes much of the support system for the students. Despite significant advancements in technology, navigating distance communication with these groups and feeling connected can be difficult. Moreover, participating students will only be at the host institution for a limited time and some may find it hard to develop strong relationships knowing that they will be returning to their home school in a few months. Others consider the program's limited time frame as a positive, because they find comfort in the shorter commitment and the ability to return to their

home institution (as opposed to a longer, potentially open-ended post-doc position). For some students, this may also be the first time they are asked to be the engineering education expert in the room, a fact that can be both exciting and nerve-racking. Finally, as with any relocation, there are some unexpected expenses that can arise such as increased travel expenses or higher housing/food prices at the host city than at your home city.

Conclusions and Future Work

Our experience has shown that this program holds great promise for graduate student development and introduction to the academic life, and that experiences like this can be a good contribution toward improving professional development within engineering graduate programs. We are seeking to continue this collaboration, with the intent to increase participation in terms of both host institutions and source engineering education programs (likely branching into a multi-institutional partnership). To develop this collaboration, we are currently engaged in assessing/evaluating the existing program, grant-seeking, and creating both institution-specific and institution-independent processes. Informal discussions with both funding organizations and potential partner schools indicate significant interest in experiences like ours.

We anticipate continuing our research efforts via this program. For example, with respect to student development, the faculty overseeing students at host institutions should have specific guidelines for promoting development – similar in some respects to the graduate advisor, but different in that professional academic positions have new expectations of which students are likely unaware and uninformed. Possible resulting research directions might be exploring the impact of experiences like REEFE on students' transition into professional communities or if, how, and why students who participate in faculty-like placements experience easier transitions into faculty appointments than those who do not. Similarly, since exposure within primarily undergraduate institutions is limited with respect to engineering education as a discipline of research, we can explore if, how, and why exposure to students competent in engineering education research influences the adoption, retention, or fidelity to research-based instructional strategies among engineering faculty. Such research will be enhanced by increased participation of both host institutions and source programs.

The REEFE program represents a novel mechanism for meeting multiple needs. It differs operationally from other preparing future faculty programs in that it is limited in scope (e.g. does not include participation in all three typical areas of academic work) and intense in timing/duration (limited to one semester). It differs conceptually from other preparing future faculty programs in that it is guided by a student/professional development framework (rather than relying primarily on experience) and is meant to serve the needs specifically of the partner institutions (instead of engaging in the larger research intensive (R1)/Primarily Undergraduate Institution (PUI) communities). As the program develops, we will work to retain the beneficial aspects of REEFE program while seeking to incorporate major lessons from other graduate development and faculty preparation programs.

Acknowledgements

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