AC 2010-528: THE EFFECT OF INTERNATIONAL DIVERSITY ON GRADUATE ENGINEERING EDUCATION: A LITERATURE REVIEW

Erin Crede, Virginia Tech

Maura Borrego, Virginia Tech

The Effect of International Diversity on Graduate Engineering Education: A Literature Review

Abstract

The purpose of this study was to integrate the previously disconnected body of knowledge surrounding the social, cultural and professional identity development of graduate students in internationally diverse engineering departments. Due to the lack of studies that focus specifically on this topic, a collection of literature was identified and an integrative literature review preformed. Articles reviewed cover a wide variety of topics, including: professional identity development, socialization experiences and social adaptation in doctoral education, culture shock and assimilation of international students in learning communities, engineering culture and the climate for graduate students, and international and domestic graduate student enrollment and admission trends, among others. These articles were critically reviewed to determine the current state of graduate engineering education for both international and domestic students. We conclude by identifying gaps and posing questions for future work relating to internationally diverse communities and graduate education.

Introduction

The prevalence of international students is a defining feature of many US graduate engineering programs. Non-US citizens accounted for two-thirds (67%) of all engineering doctorate recipients in 2006 [1]. After two years of decline, first time graduate enrollment in science and engineering increased in 2006—by 16% for foreign students but only 1% for domestic students [2]. A recent report by the Council of Graduate Schools indicates a shift in enrollments during the 2007/2008 academic year for engineering departments, with enrollment of US citizens increasing 10.9% compared to a 5.5% increase in international enrollments. Despite these fluctuations, the past 10 years have seen an average annual change in graduate enrollment in engineering of 1.2% for US citizens and permanent residents, and 6.3% for international students [3].

To date, much of the research regarding the recruitment and retention of doctoral students has focused on examining student characteristics and factors external to the university, such as undergraduate GPA, gender and marital status [4, 5]. While these quantitative studies have yielded a broad overview of possible factors that influence the decision to leave doctoral study, we have yet to fully conceptualize the engineering graduate student *experience*. Additional studies have focused on the interaction between the student and the department or discipline, but did not incorporate engineering students [6, 7]. Previous studies have included a broad range of disciplines, examining the statistically significant differences in program completion rates, and identifying characteristics that distinguish one discipline from another. Paramount among these cited differences was the large proportion of international students attending US graduate engineering programs [4, 8].

Existing research on enculturation and adaptation of student sojourners focuses heavily on the experiences of undergraduate students studying abroad, with very few studies considering the experiences of graduate students. Within the field of graduate education, research centers on the pursuit of a doctoral degree with the intention of obtaining a faculty position, with other studies

investigating professional identity development, and how students become members of their professional community. Both undergraduate and graduate engineering education researchers have published a great deal on recruitment and retention, or attrition, in their respective areas. While all of this research has greatly increased our knowledge about how international students adapt to a new culture and how graduate students adjust and persist in graduate school, no single study has attempted address how international students affect the graduate engineering education community. The purpose of this review is to present an overview of the literature surrounding engineering graduate education, with the aim of highlighting future research questions surrounding the influence of international students.

Methods

To obtain the articles reviewed in the next section, an extensive search of the literature was performed during August through March of 2008. Using a university library system, databases including ERIC, Education Research Complete and PsycINFO (from EBCOHost), as well as Compendex (from Engineering Village) were searched for articles of interest. This search generated approximately 40 articles using combinations of the following key words: engineering graduate education, doctoral education, identity, culture, enculturation, acculturation, and socialization. Additionally, the reference list of each of the articles was scanned for additional publications fitting the keywords. The publications cited here are not meant to be an all inclusive list of the literature on the topic, but serve to highlight the areas for collaboration among researchers publishing in previously disconnected areas that have previously published articles related to engineering graduate education.

Upon completion of the literature search during the spring of 2008, all of the articles were reviewed to ascertain whether they were in fact relevant to the study. Using the methods prescribed for narrative and integrative literature reviews[9, 10], an inductive approach was used to explore what topics were discussed in each article and how these related back to the purpose of the study. From here each article was examined again to determine the key argument, findings and purpose of the research. Articles with similar purpose statements or findings were grouped together, and this iterative process continued until all articles had a place in one of four categories: identity, socialization, culture and career intentions. These are shown graphically in Figure 1.

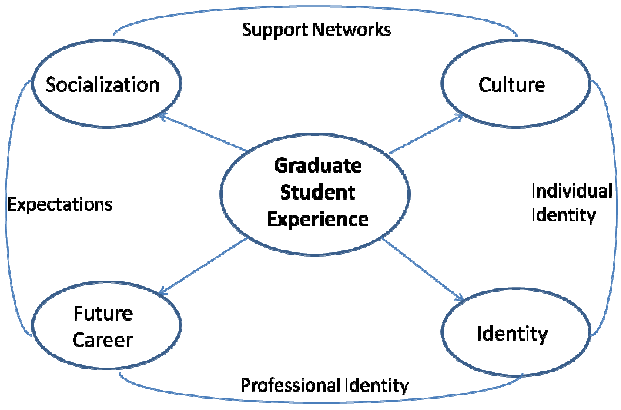

Figure 1. Modeling the Graduate Engineering Student Experience

As can be expected there were several articles that had topics or keywords that made it a candidate for multiple categories. During the categorization process there were several common themes that emerged between pairs, or were common across multiple categories. We have attempted to account for these along with the main categories, indicated by the connecting lines in Figure 1. Each of these categories contributes to the graduate school experience of both international and domestic students. In the following sections we develop each of these categories and explore how each affects an engineering student (both international and domestic) during their graduate education.

Exploring the Engineering Graduate Student Experience

The following sections detail the four main bodies of literature surrounding international and graduate education which include: graduate student identity development, enculturation into learning communities, socialization experiences and future career plans. These are not all inclusive, but represent a wide range of literature which was used to model that graduate student experience.

Graduate Student Identity Development

Engineering as a profession, like medicine or law, is endowed with a set of professional knowledge and associated skills that are accepted as a requirement of each new member. In order to obtain this required knowledge and skill base, students participate in lengthy degree programs and/or apprenticeships. During these experiences, students observe the behaviors, norms and attitudes that are prevalent among the profession's practitioners. During this time, students begin to craft their professional identity by "trying on" possible images of themselves to see how well they fit [11]. One way these images are established is through the individual's professional developmental network, and the relationships students have with members of their profession and learning community (e.g their department or research group) [12]. Sweitzer[12] explored how other members of the student's developmental network (friends, peers, and family) contributed to their professional identity development and how this translated to "fit" within a doctoral program in business. She found that students' relationships to members outside of the academic community significantly impacted how their professional identities were shaped during their doctoral program.

Individual identities are often associated with social positions or roles. Role labels convey meaning and expectations for behavior that have evolved with the profession. Consider the examples in an engineering department in a university. Labels such as "freshman", "teaching assistant", and "first year doctoral student" convey different sets of expectations for how these individuals will spend their time compared to "senior", "research assistant" and "post-doc" [11]. Roles are defined both externally by others' expectations, and individually by internally accepting or rejecting the expectations of a given role [13]. Once a graduate student has accepted a given role, it becomes part of his or her identity and serves as a framework for evaluating future experiences.

Engineering graduate students are not limited to one role (or identity), and oftentimes these students have as many identities as groups in which they engage in distinctive roles [13]. For example, an engineering graduate student may be have an interest in teaching but is serving as a

research assistant, or a student from India might have culturally rooted expectations regarding what a student should "do" or "be". In cases where students have multiple identities, they will organize these in a hierarchy where the salience of a given identity is based on the situation[14]. The presence of multiple identities can have both positive and negative effects on graduate engineering students. When a given identity strengthens the commitment to another identity, then these identities are mutually reinforcing and an increase in commitment to one or both may result. On the other hand, if two or more of the students' identities are in conflict, the student will choose the identity most salient to him or her, leading to a perceived increase in pressure and stress [11]. Fragmenting student roles into separate jobs, such as teaching, research and community or cultural associations, fails to allow students to exploit the connections between the two and presents a potential conflict of individual identities. Doctoral students may also accept the multiple roles of student, teacher and researcher, but arrange them in a different hierarchy than their graduate institution [12]. When individuals are confronted with a persistent conflict of individual identities, one possibility is to simply exit the role [15]. Establishing an environment in engineering graduate education that enables students to balance multiple identities may help reduce perceived stress and pressure on graduate students, leading to reduced graduate student attrition.

Enculturation into Engineering Learning Communities

In addition to the identity related difficulties experienced by incoming graduate students, sojourners, or students who attend an institution of higher learning in another country, face a variety of cultural and behavioral differences, as well as a different set of expectations compared to their home country. The vast majority of the literature surrounding student sojourners focuses on the problems of adaptation to the host country and discusses issues such as enculturation, acculturation, assimilation and culture shock. An article published in 2008 presents an overview of the theoretical development of culture shock in the context of student sojourners and seeks to clarify and extend these theories [16]. Early research on culture shock began in the 1950's with the examination of mental health issues related to studying abroad[17, 18] (Refer to Table 1 in Zhou et al[16] for a summary of the traditional theoretical approaches to culture shock). During the 1980's research on culture shock shifted to view student sojourning as a learning experience and noted that steps should be taken prior to travel to prepare the student, [19] potentially alleviating some of the "shock" upon arrival to the host country. This perspective treated studying abroad as a dynamic learning experience for both the student and the host country, and served to lay the foundation for contemporary perspectives on intercultural contact [16]. The three contemporary theories are more comprehensive and consider the different components of how students respond to new environments: affect (stress and coping), behavior (culture learning), and cognition (social identification). These three theories are often combined into what is now called the ABC model. Theoretical details on each of these theories are well summarized[16] and the authors conclude that "culture shock" is really "contact induced stress accompanied by skill deficits that can be managed or ameliorated" (pg 65). This suggests that there are steps programs and universities can take to assist students, and has led to the increasing use of terms like "adaptation" and "acculturation" in the literature today.

From the closely linked theories relating to the ABC model, researchers have published literature focusing specifically on international student sojourners. One such article examines the three

distinctive social networks used by students, each serving a specific function [20]. The primary network is communication with their home country, which provides a link to cultural behaviors and values. This is followed by interactions with host nationals, providing academic support and culturally relevant skills for relating to the host country. Finally, students develop a social network of other international students, which provides mutual social support. These networks were classified by Furnham [21] as mono-cultural, bi-cultural and multi-cultural friendship networks, respectively.

The other side of this story, previously discussed in one facet as identity development, requires adapting to the role of a graduate student, regardless of nationality. Engineering, as a professional community, must pass along the values and norms of the discipline to all students pursuing graduate degrees. A 1994 study found the importance of technical mentoring—which may include basic information on how work is done in accordance with the norms of research—is substantial and appears to be the key to transmitting traditional values between one generation of scientists and another, particularly when the next generation comes from a culturally different background [22]. Anderson *et al*[22] examined the views of doctoral students with respect to academic research. The focal variables for their analysis were subscription to the academic norms as described by Merton [23], and subscription to the counternorms, based on Mitroff's work [24]. A replication of the wording used for norms and counternorms is given in Table 1. Their findings are based on a nationwide survey of students in chemistry, sociology, microbiology and civil engineering, with main comparisons based on gender, discipline and nationality.

Table 1. Component Items of Norm and Counter Norm Scales. *Reproduced from Anderson*[22]

NORMS	COUNTERNORMS
Universalism- Scientists evaluate research only on its merit, i.e. according to accepted standards of the field.	***Particularism-*** Scientists assess new knowledge and its applications based on die reputation and past productivity of the individual or research group.
Communality-Scientists openly share new findings with all colleagues.	***Solitariness-*** Scientists protect their newest findings to ensure priority in publishing, patenting, or applications.
Disinterestedness- Scientists' are motivated by the desire for knowledge and discovery, and not by the possibility of personal gain.	***Self-Interestedness-*** Scientists compete with Others in the same field for funding and recognition of their achievements.
Organized Skepticism- Scientists consider all new evidence, hypotheses, theories, and innovations, even those that challenge or contradict their own work.	***Organized Dogmatism-:*** Scientists invest their careers in promoting their own most important find

The largest gap between any two groups is found in the case of U.S. versus non-U.S. student support for the counternorms[22]. The main effects in the analysis of disciplinary differences come from the civil engineering students, (who were chosen to be representative of other engineering disciplines). These engineering students show the weakest support for the norms and the strongest support for the counter norms, compared to the other degree programs. The authors conclude that the data suggest the need to incorporate broader cultural theories into our understanding of the value system of science. They further argue that it would be useful to

determine whether or not there are sub cultural differences within the group of U.S. citizens, which might have implications for efforts to recruit and retain students from diverse backgrounds in the sciences and engineering.

Additional works have examined enculturation [25] at institutions of higher learning, but virtually no literature addresses the specific experiences of international graduate students in engineering. In their literature review, Zhou *et al* conclude that the current theoretical models are not without their limitations and that more research needs to be accomplished to synthesize theories into a coherent framework. Assuming that adaptation, acculturation or enculturation is possible, future research should address this issue by investigating experiences or programs that assist students in managing stress and "skill deficits", while accounting for disciplinary differences. While there are several studies have investigated acculturation for undergraduate students, there remains a need to further explore the experiences of international graduate student sojourners who face the dual problem of adapting to both a new host culture along with the cultural differences and expectations of graduate school. There are few graduate programs where these international students are more strongly represented than in the engineering disciplines.

Finally, Zhou et al[16] note that the rapid increase in the number of international students has led to a heightened awareness of the pedagogical differences in differing cultures. Future research is needed to "clarify current teacher and student expectations in order to learn how mismatches occur, and to begin to explore how these might be resolved" [16]. Examination of the differing expectations associated with international students will yield valuable information for increasing the numbers of engineering graduate students, and reducing attrition from graduate programs.

Socialization Experience of Engineering Graduate Students

Socialization is the process through which an individual learns to adopt the values, skills, attitudes, norms, and knowledge needed for membership in a professional community; in the case of engineering, as a professional researcher or faculty member [26-32]. In the case of international students, socialization may also encompass an understanding of the social expectations and cultural norms of the host country. Socialization plays an important role in the graduate school experience, and when unsuccessful, may contribute to the decision to depart the degree program. Where graduate student socialization differs from professional socialization is in the requirement that graduate students become socialized not only to the graduate school environment, but to the professional role as well [33]. Issues relating to graduate student socialization are discipline-specific, meaning that studies within graduate education must focus on a particular departmental and environmental context to gain an understanding of the relationships involved [4, 33].

Related to international student socialization, a study conducted in Russia focused on the issue of the social adaptation of undergraduate student sojourners [34]. This article combines some of the elements of cultural adaptation and culture shock discussed in the previous section, with a socialization lens to understand the experiences of engineering students who come to Russia for their undergraduate education. The authors assert that it is the job of the host country to "provide the optimal conditions for [student sojourners'] living and educational needs (pg 23)" and that one of the main foci for research should be the extent to which the new arrivals are prepared to

adapt to a new environment[34]. This echoes the argument proposed by Zhou et al[16], that students are able to overcomes the stress of adapting to a new environment if properly prepared. They proceed to argue that one of the notable differences in the cultural climate may stem from the differences between a traditional and modern society. Traditional societies are characterized by a social structure with the hierarchy based on membership in a class or caste, making relationships with the family and friends the most important. Contrast this with modern societies, which value social mobility and high individual achievement or professional status. Also noted is the importance of the relationship between what is expected and the reality of the experience, indicating that how students choose an institution contributes to their expectations about studying abroad. So the question remains of what constitutes social adaptation? What factors indicate that a student sojourner has successfully adjusted to a new culture or environment? This study posits that the students' attitude toward the host country both in an emotional and behavioral sense characterizes their adaptation to Russia. However the other indicators that the authors present, including overall satisfaction with Russian life, appropriate functioning in the role of student, and positive perception of the new environment, could serve as indicators of adjustment to graduate school as well, a factor not considered by the present study.

Another socialization study focused on graduate education, by examining the experiences of doctoral students in high and low completing departments[35]. This study considered the disciplinary differences in doctoral education, noting that electrical and computer engineering was often considerably different than the other five departments studied, and represented the lowest completing department. The four themes that emerged from this study included: support, self direction, ambiguity and transition. Interestingly, the author found that engineering students (unlike all of the other disciplines) depended more on faculty for support than their peers, and attributes this to the high percentage (over 50%) of international students in the engineering department. Engineering students also experienced the theme of self direction differently than students from other departments. Engineering students felt that self direction meant learning how to do research independently, something that you had to teach yourself because that information could not be obtained from a class. Students from other non engineering departments cited their peers as a key mechanism for learning new material. Finally, relating to transition, students in engineering again offered the majority of the comments, which the author attributes to the various transition issues that international students must face in addition to the transition from undergraduate to graduate school. In addition to the above instances, the author makes multiple mentions of the high percentage of international students in engineering, arguing that considerable research needs to be done to understand how they influence the graduate student experience [35].

Several other researchers have discussed the socialization of graduate students in the form of a multi-stage process, and are representative of the developmental nature of the socialization process [36]. Examples include the four stages presented by Weidman and coworkers [37, 38] and Lovitts [8] that express socialization in regard to prior anticipatory socialization to the graduate school environment, through culmination of the degree and entrance into the profession. While these previous models have paved the way for future research, they fall short of explaining the complexity of the graduate student experience as they focus more on individual program elements, such as coursework and qualifying exams, rather than the transformation of the student during his or her educational experience. The inherent complexity of this problem requires a

variety of more focused studies at the program and department level, and investigating differences across sub-disciplines and institutional types.

Career Plans of Engineering Graduate Students

Another topic featured in a large amount of engineering specific literature on graduate education is preparing engineering graduate students for their future careers (faculty versus industry) [39-43] or for positions they may hold during graduate school (teaching versus research assistant) [44-49]. The majority of the research on preparing students for future careers centers on the relatively small number of engineering doctoral students pursuing faculty appointments. Likewise, the majority of research on training graduate students is focused on training students for graduate teaching assistant positions, with many schools creating training programs that give students teaching responsibility in the hopes they pursue faculty positions upon graduation. Several of these studies mention the role of international students and the additional language difficulties they experience in a teaching assistant position, however there are few studies that probe deeply into the experiences of these students.

Another series of publications by the Carnegie Initiative on the Doctorate focuses on preparing the future stewards of the discipline [33]. This series discusses the state of doctoral education as a whole and argues that disciplinary differences must be accounted for and researched further. As mentioned in several other works, one of the predominant differences between engineering and other disciplines is the high population of international students, making it a bright area for future research[4, 8, 35].

Conclusions and Suggestions for Future Research

In this paper we have summarized a variety of research relating to graduate student identity development, socialization and future career plans, highlighting the additional cultural difficulties faced by international students. From this review we present the following summary points:

- Socialization, enculturation, and identity development are not mutually exclusive, and future research should focus on the experiences of graduate students to adequately capture these developmental traits
- While the literature is relatively conclusive about the importance of disciplinary differences in graduate programs [6], few studies have focused on the experiences of engineering graduate students.
- One of the predominant differences between engineering and other disciplines is the high population of international students [4, 8, 35]

Each of the previously discussed research areas have themes that are common among them, not least of which the discussion of the role international students play. However, many of these research areas focus on only the undergraduate experience and ignore the graduate experience as is the case with much of the cultural adaptation and engineering education literature. Much of the graduate education literature highlights the presence of international students as a defining feature, but little work has been done to understand these student experiences both from the point of view of the visiting student and the impact on the domestic students already in residence. The

inherent complexity of this problem requires a variety of more experience focused studies at the program and department level, and investigation of differences across sub-disciplines and institutional types.

Suggestions for Future Research

After reviewing the current state of the literature on international graduate engineering education we would like to suggest the following questions for future research:

1. How can we incorporate engineering students into more studies of graduate education?
2. How does the current graduate engineering department prepare doctoral students for careers in industry?
3. What are the salient characteristics of graduate engineering community (or culture)? How does it differ across institutions and departments?
4. What untapped opportunities exist for training domestic students to work in more global settings by working with international students studying in the US?
5. How do engineering graduate students interact in a lab setting, and how does this affect their social and cultural adaptation?

The continued increase of international students attending US colleges and universities presents a unique opportunity for engineering education researchers to contribute to the growing body of knowledge on graduate education. If the US wishes to remain a paramount destination for international students, as well as a global power for engineering and technology, a fuller understanding of how these students impact the culture of graduate engineering departments is needed.

References

1. NSF, *U.S. Doctoral Awards in Science and Engineering Continue Upward Trend in 2006*. 2007: Arlington, Va.
2. NSF, *First-Time, Full-Time Graduate Student Enrollment in Science and Engineering Increases in 2006, Especially Among Foreign Students*. 2007, National Science Foundation: Arlington Va.
3. Council of Graduate Schools, *Graduate Enrollment and Degrees: 1998 to 2008*. 2008: Washington DC.
4. Nettles, M.T. and C.M. Millett, *Three Magic Letters-Getting to PhD*. 2006, Baltimore, MD: The Johns Hopkins University Press. 329.
5. Abedi, J. and E. Benkin, *The effects of students' academic, financial, and demographic variables on time to the doctorate.* Research in Higher Education, 1987. **27**(1): p. 3-14.
6. Golde, C.M., *The Role of the Department and Discipline in Doctoral Student Attrition: Lessons from Four Departments.* The Journal of Higher Education, 2005. **76**(6): p. 669-700.
7. Golde, C.M., *Beginning Graduate School: Explaining First-Year Doctoral Attrition.* New Directions for Higher Education, 1998. **1998**(101): p. 55-64.
8. Lovitts, B.E., *Leaving the Ivory Tower: The Causes and Consequences of Departure from Doctoral Study*. 2001, Lanham, MD: Rowman and Littlefield Publishers Inc. 307.
9. Baumeister, R.F. and M.R. Leary, *Writing Narrative Literature Reviews.* Review of General Psychology, 1997. **1**(3): p. 311-320.

10. Cooper, H.M., *Scientific Guidelines for Conducting Integrative Research Reviews.* Review of Educational Research, 1982. **52**(2): p. 291-302.
11. Colbeck, C.S., *Professional identity development theory and doctoral education.* New Directions for Teaching and Learning, 2008. **2008**(113): p. 9-16.
12. Sweitzer, V.B., *Towards a theory of doctoral student professional identity development: A developmental networks approach.* Journal of Higher Education, 2009. **80**(1): p. 1-33.
13. Stryker, S. and P.J. Burke, *The past, present, and future of an identity theory.* Social Psychology Quarterly, 2000. **63**(4): p. 284-297.
14. Stryker, S., *Identity Salience and Role Performance: The Relevance of Symbolic Interaction Theory for Family Research.* Journal of Marriage and Family, 1968. **30**(4): p. 558-564.
15. Cast, A., *Identities and Behavior*, in *Advances in Identity Theory and Research*, P. Burke, et al., Editors. 2003, Kluwer Academic/Plenum Publisher: New York.
16. Zhou, Y., et al., *Theoretical Models of Culture Shock and Adaptation in International Students in Higher Education.* Studies in Higher Education, 2008. **33**(1): p. 63-75.
17. Byrnes, F.C., *Role Shock: An Occupational Hazard of American Technical Assistants Abroad.* Annals of the American Academy of Political and Social Science, 1966. **368**(ArticleType: primary_article / Issue Title: Americans Abroad / Full publication date: Nov., 1966 / Copyright © 1966 American Academy of Political and Social Science): p. 95-108.
18. David, K.H., *Culture shock and the development of self-awareness.* Journal of Contemporary Psychotherapy, 1971. **4**(1): p. 44-48.
19. Bochner, S., *The social psychology of cross-cultural relations*, in *Cultures in contact: Studies in cross-cultuaral interaction*, S. Bochner, Editor. 1982, Pergamon: Oxford. p. 5-44.
20. Bochner, S., B. McLeod, and A. Lin, *Friendship patterns of overseas students: A functional model.* International Journal of Psychology, 1977. **12**: p. 277-297.
21. Furnham, A., *Foreign students: Education and culture shock.* The Psychologist, 2004. **17**(1): p. 16-19.
22. Anderson, M.S. and K.S. Lewis, *The Graduate Student Experience and Subsciption to the Norms of Science.* Research in Higher Education, 1994. **35**(3): p. 273-299.
23. Merton, R.K. and E. Barber, *Sociological Ambivalence*, in *Sociological Theory, Values and Sociocultural Change*, E.A. Tiryakian, Editor. 1963, The Free Press: Glencoe. p. 91-120.
24. Mitroff, I.I., *Norms and Counter-Norms in a Select Group of the Apollo Moon Scientists: A Case Study of the Ambivalence of Scientists.* American Sociological Review, 1974. **39**(4): p. 579-595.
25. Clark, J., D. Dodd, and R.K. Coll, *Border Crossing and Enculturation into Higher Education Science and Engineering Learning Communities.* Research in Science and Technological Education, 2008. **26**(3): p. 323-334.
26. Bess, J.L., *Anticipatory Socialization of Graduate Students.* Research in Higher Education, 1978. **8**(4): p. 289-317.
27. Kuh, G.D. and E.J. Whitt, *The Invisible Tapestry. Culture in American Colleges and Universities*. 1988: Association for the Study of Higher Education. 160.
28. Maanen, J.V. and E.H. Schein, *Toward a Theory of Organizational Socialization*, in *Research in Organizational Behavior*, B. Staw and L.L. Cummings, Editors. 1979, JAI Press: Grenwich, Connecticutt.
29. Merton, R.K., *Social Theory and Social Structure*. 1957, New York: Free Press. 253.
30. Pruitt, F.J., *The Adaptation of African Students to American Society.* International Journal of Intercultural Relations, 1978. **2**: p. 90-118.
31. Salomon, G. and D.N. Perkins, *Individual and Social Aspects of Learning* Review of Research in Education, 1998. **23**: p. 1-24.
32. Ward, C. and A. Kennedy, *Where's the "Culture" in Cross-Cultural Transition?* Journal of Cross Cultural Psychology, 1993. **24**(2): p. 221-249.
33. Golde, C.M. and G.E. Walker, eds. *Envisioning the Future of Doctoral Education*. First ed. 2006, Jossey-Bass: San Francisco. 450.
34. Dorozhkin, I.N. and L.T. Mazitova, *Problems of the Social Adaptation of Foreign College Students.* Russian Education and Society, 2008. **50**(2): p. 23-30.
35. Gardner, S., *Student and faculty attributions of attrition in high and low-completing doctoral programs in the United States.* Higher Education, 2009. **58**(1): p. 97-112.
36. Baird, L.L., *Using research and theoretical models of graduate student progress*, in *Increasing graduate student retention and degree attainment* L.L. Baird, Editor. 1993, Jassey-Bass: San Francisco. p. 3-12.

37. Weidman, J.C. and E.L. Stein, *SOCIALIZATION OF DOCTORAL STUDENTS TO ACADEMIC NORMS.* Research in Higher Education, 2003. **44**(6): p. 641-656.
38. Weidman, J.C., D.J. Twale, and E.L. Stein, *Socialization of graduate and professional students in higher education: a perilous passage?* ASHE-ERIC Higher Education Report. Vol. 28. 2001, San Fransisco: Jossey-Bass.
39. Austin, A.E., *Preparing the Next Generation of Faculty: Graduate School as Socialization to the Academic Career. The Journal of Higher Education*, 2002. **73**(1): p. 29.
40. Austin, A.E. and D.H. Wulff, *The challenge to prepare the next generation of faculty*, in *Paths to the professoriate: Strategies for enriching the preparation of future faculty*, D. Wulff and A. Austin, Editors. 2004, Jossey-Bass: San Francisco.
41. Council of Graduate Schools. *Preparing Future Faculty Program*. 2009; Available from: http://www.preparing-faculty.org/.
42. Reis, R.M., *Tomorrow's Professor: Preparing For Academic Careers in Science and Engineering*. 1997: IEEE Press.
43. Crede, E.D. and M. Borrego, *Preparing Graduate Engineering Students for Academia: Assessment of a Teaching Fellowship*, in *2009 ASEE Conference and Exposition*. 2009.
44. Borrego, M. *Assessment of a Prestigious Engineering Graduate Teaching Fellowship Program*. in *2008 ASEE Annual Conference and Exposition*. 2008.
45. Brannon, M.L. and S. Zappe. *Preparing Graduate Students to Teach: A Seminar on Teaching for Graduate Assistants in Engineering*. in *2009 ASEE Annual Conference and Exposition*. 2009. Austin, Texas.
46. Capobianco, B.M., H. Diefes-Dux, and E. Oware, *Engineering a Professional Community of Practice for Graduate Students in Engineering Education*, in *ASEE/IEEE Frontiers in Education Conference*. 2006: San Diego Ca.
47. Cho, P. and W. Predebon, *A Teaching Assistant Training Program with a Focus on Teaching Improvement and Graduate Student Development*, in *ASEE Annual Conference Proceedings*. 1996.
48. Kane, R., et al. *An Integrated Approach to Teaching Assistant Training and Orientation*. in *2007 ASEE Annual Conference*. 2007.
49. Turner, M.M., *The Research Team Concept, II: (Still) An Approach to Graduate Training*. Communication Research Reports, 2006. **23**(3): p. 225-230.