
GRADUATE STUDENT MENTORING MANUAL

FIRST EDITION

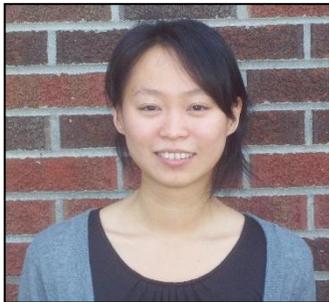


**International Institute for
Engineering Education Assessment**
Identifying Problems | Assessing Progress | Enhancing the World

About the authors



Monica F. Cox, Ph.D., a native of Newville, Alabama, is the Director of the International Institute for Engineering Education Assessment (I2E2A), is an Associate Professor in Purdue University's School of Engineering Education (ENE), is a Visiting Professor at the Universidad de las Americas, Puebla, Mexico (UDLAP), is the Interim Director of the Indiana Louis Stokes Alliance for Minority Participation, and is the Inaugural Director of Purdue College's of Engineering Leadership Minor.



Jiabin "Emily" Zhu is an Assistant Professor at Shanghai Jiao Tong University. She received her Bachelor of Science degree in Physics from East China Normal University and her Master of Science degree in Optics from Chinese Academy of Sciences. She received a second Master's degree in Biomedical Engineering from Purdue University. In the spring of 2013, she obtained her Ph.D. from the School of Engineering Education at Purdue University. While in the doctoral program, she served as a research assistant in multiple projects on the training and mentoring of engineering doctoral students. Her primary research interests relate to epistemological development of college and graduate students, comparative study methods and frameworks in engineering education, global engineering and mentoring of engineering graduate students.



Benjamin Ahn is a Ph.D. student in the School of Engineering Education at Purdue University. He received his B.E. in Aerospace Engineering from the University of New South Wales Australia, and a M.S. in Aeronautics and Astronautics Engineering from Purdue University. His research interests include identifying effective mentoring skills in undergraduate research settings, exploring leadership development of undergraduates, and determining professional engineering practices in universities and industries. Ahn's research has been strongly motivated by challenging, exciting, and inspiring experiences he has had as a teaching assistant in first-year engineering classes and as a graduate assistant for Purdue's Summer Undergraduate Research Fellowships (SURF) program and Purdue's Minority Engineering Program (MEP).



Cyndi Lynch is the Director of Fellowships and Graduate Student Professional Development for the Graduate School. Cyndi administers the fellowship program for the university, counseling students on fellowship applications and fostering positive experiences for fellows. Through her research in higher education administration, Cyndi created the Graduate Student Professional Development program. Implemented in 2003, the program fosters graduate student professional development through developing effective writing strategies, mentoring, and career management. Cyndi instructs Purdue’s Preparing Future Faculty course and the Preparing Future Professionals course, designed to facilitate graduate students transition into faculty positions and non-academic positions respectively.



Diana Bairaktarova is an Assistant Professor of Engineering Practice in the College of Engineering at The University of Oklahoma. She completed her Ph.D. in Engineering Education from Purdue University with a dissertation focused on the efficacy of mechanical objects in engineering learning. Diana holds BS and MS degrees in Mechanical Engineering from Technical University in Sofia, Bulgaria and an MBA degree from the Hamline School of Business, St. Paul, Minnesota. Diana has

over a decade of experience working as a Design Engineer.



Tasha Zephirin is pursuing her PhD in Engineering Education at Purdue University. She was first introduced to engineering education research as an undergraduate Electrical Engineering student assisting with first-year engineering courses at Virginia Tech—specifically with the development and assessment of a Mechatronics activity. Currently, she is a part of the Integrative Graduate Education and Research Traineeship in Magnetic and Nanostructured Materials (IGERT-MNM), a collaborative interdisciplinary graduate program initiative between Norfolk

State University, Cornell University, and Purdue University. One of her efforts in the IGERT-MNM program included the development of a “Best Practices in Teaching and Learning” module to help Trainees identify ways their technical research can be transferred to other formal and informal learning environments guided by educational research and theories. Her current research interests include investigating how organizational culture influences the development of engineering programs and how storytelling is used in engineering contexts. She is also an active member and former leader in the National Society of Black Engineers (NSBE).

Additional Contributors



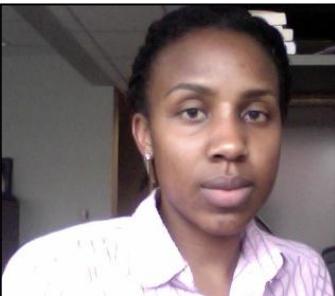
Amadin Osagiede, MSCE
MBA Candidate
Krannert School of Management
Purdue University



Gabriela Campos
Undergraduate Student
School of Mechanical Engineering
Purdue University



Anne Tally
Undergraduate
School of Informatics and Computing
College of Arts and Sciences
Indiana University



Velvet Fitzpatrick, MSCE
PhD Candidate
School of Engineering Education
College of Engineering
Purdue University



JD McClurkin, MSABE
PhD Candidate
Agricultural and Biological Engineering
College of Engineering
Purdue University

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How to Use This Manual

Each module within this manual contains activities framed around the elements in the table below. The organization of each module has been adapted from training activities within the critically acclaimed Posse Foundation program, a program that sends cohorts of students to colleges and universities across the United States in groups, or “posses” (The Posse Foundation, 2013). Modules can be completed individually or among a group of students and can be used collectively or as stand-alone modules. We anticipate that each module can be completed in approximately one hour, although this time can be adjusted as needed.

This manual reflects just a few topics that might be pertinent to a graduate student. Special efforts have been made to focus on topics that are not taught in traditional classrooms or are usually learned informally by graduate students or early career faculty. At the end of this experience, we anticipate that students will be able to “hit the ground running” as professionals in academic or nonacademic settings.

Module Element	Purpose of This Element
LOCATE	Students identify their existing perceptions and experiences
EVALUATE	Students informally assess their views
ABSORB	Students learn formal, preexisting knowledge
DEMONSTRATE	Students apply content in actionable ways
EVOLVE	Students communicate how they will apply content in their career and professional development
REFLECT	Students process and summarize their thoughts

The Posse Foundation. (2013). Retrieved from www.possefoundation.org

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1 ~ PROFESSIONAL IDENTITY MODULE

Jiabin Zhu and Cyndi Lynch

Module Overview - This module will help students to identify their “brands” or ways that they want to present themselves in professional environments. Students will create a one-page professional development plan that will help them to engage in activities that promote their career goals.

1.1 ~ SETTING THE CONTEXT

A professional identity is the skills, attributes, and competencies that one portrays to colleagues in a professional environment. A professional identity is what makes you unique and separates you from others in a job interview. A strong professional identity is an essential component of an effective career portfolio and requires time to cultivate. Armed with this knowledge, graduate students should start early in their graduate careers to strategically cultivate their professional identity, making full use of the time and resources available while in graduate school.

Moreover, in the process of cultivating their professional identities, graduate students need to learn how to obtain timely and effective feedback from multiple sources, such as peers, advisors, mentors, etc. Via the feedback process, graduate students will be able to acknowledge their strengths, identify weaknesses and promote professional growth.

1.2 ~ WARM UP

Take a few moments to answer the following questions:

- What is your career goal?
- List the skills, competencies, and experiences that are necessary to achieve your career goal.
- State the evidence that supports your claim of skills, competencies, and experiences.

Reflect on the extent to which you were able to answer these questions. In what ways are you strong? In what ways would you like to develop?

1.3 ~ BACKGROUND

The topic of Professional Identity will be addressed in the following four aspects. As you follow through these four aspects, jot down your thought about each reflective questions and start building your professional identity!

Reflective Question: As you think about your opportunities, what claims are you making about your skills and experiences? What evidence do you have that supports these claims based on your chosen career field?

Skills and Experiences

Possessing certain skills, attributes or experiences is essential to a successful career. These skills, competencies, and experiences will vary based on the

career field. For example, to be a productive faculty member at a research intensive university, one needs substantial research experience and technical skills, the ability to develop an independent research agenda through securing external funding, experiences in teaching and engaging students, and effective mentoring skills. Identifying key skills and competencies early in your graduate program affords the ability to develop these skills while in graduate school. A clear understanding of your career goals and opportunities allows you to plan accordingly and strategically develop the skills that are essential to your career success. These core skills, attributes or experiences will then become your “Professional Identity”.

Supposing that you are pursuing the role of a faculty member, you make some claims about your skills in areas such as Discovery, Learning, Services, Budgeting, Mentoring Skills, etc. (Figure 1). As you make these claims about your skill sets or abilities, you need substantial evidence to support your claims. Documentation, such as publications or course evaluations, or lived experiences serve as tangible evidences to support your stated skills, attributes, or expertise for your future roles, particularly when your recommenders substantiate these claims in their recommendations. In this case, you may cite the number or tier of your academic publications, your experiences in leading research projects, or your experience with writing a research proposal to support that you do have strong research skills. You may also provide evidence of your

teaching excellence, such as a teaching award, or student quotes from course evaluations.

In contrast, professionals pursuing career opportunities in small business, corporate sector, government, or non-profit organization require different skill sets, such as leadership skills, teamwork skills, mentoring skills, etc. (Figure 2). As noted previously, you will need to provide evidence that supports your claims of these skills. To hold leadership positions in community groups or student organizations suggests that you may have rich experiences in leading a group of people. To have mentoring experiences with some undergraduate students could serve also as good evidences for your skills to mentor and coach people. Experience of working in a multidisciplinary team may suggest your ability to collaborate with a diverse team. Developing a portfolio to document these evidences or experiences will help you to keep track of the development of your professional identity so that you may be able to identify areas that still need more work and therefore prioritizing your time and efforts. Moreover, a good documentation of the evidence will later help you in conveying your professional identity to different audiences. As you think about your career goals, you would start to focus on the core skills or abilities that are essential to your career objective.

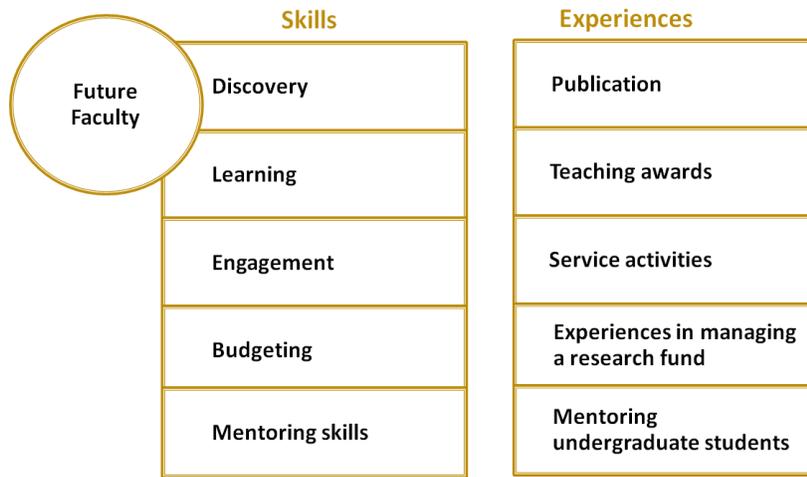


Figure 1 - Sample Skills and Experiences for Future Faculty

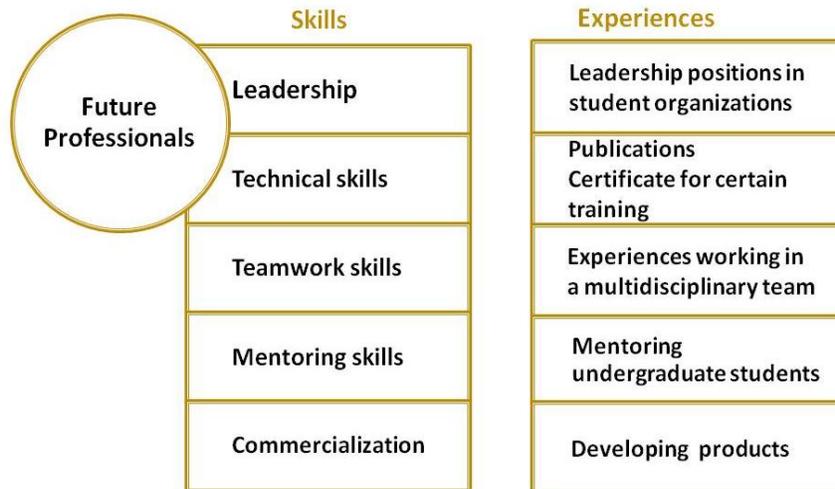


Figure 2 - Sample Skills and Experiences for Future Professionals

1.4 ~ EXPERIENTIAL EXERCISE

Take 3-5 minutes now and write down 3-5 skills or competencies that would represent your (future) professional identity and identify the experience that would serve as a good evidence for your professional identity.

1.5 ~ PROCESS

What methods do you use when interacting with others to convey your professional identity?

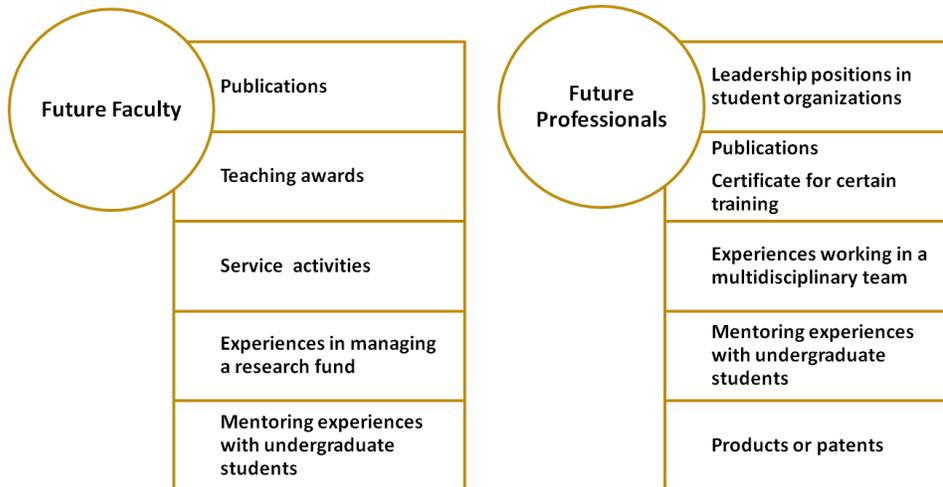


Figure 3 – Sample Experiences for Future Faculty and Professionals

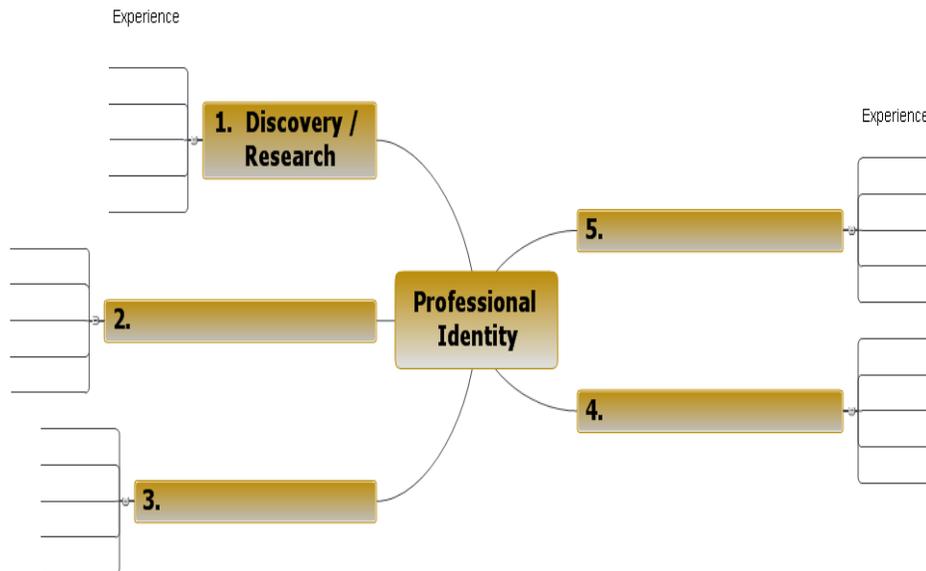


Figure 4 – Template for Mapping One's Professional Identity

As above-mentioned, a good record of the evidence of your professional identity will facilitate the process of conveying your professional identity. There are different methods or formats to convey your professional identity, including, oral, written or non-verbal ways. Conveying your professional identity through different avenues will facilitate your development of a professional network, thus exposing you to different career opportunities. A list of different ways to convey your professional identity is shown in Figure 3. Bear in mind that, as

you are conveying your professional identity to different audiences in different ways, you should obtain feedback from appropriate audiences.

1.6 ~ CLOSURE

- What are your action items to develop your professional identity?
- What are the ways you will adopt to obtain feedback in order to enhance your professional identity?

2 ~ PROFESSIONAL WRITING MODULE

Monica F. Cox, Benjamin Ahn, and Diana Biaraktorova

Module Overview: This module will provide students with suggestions for writing across multiple venues. Special emphasis will be placed on writing grant proposals and publishing in journals within one's field.

2.1 ~ SETTING THE CONTEXT

At the end of the module, you should be able to

- Distinguish between writing expectations for a variety of venues and audiences (i.e., journals, grants, conference papers, and review articles).
- Identify personal areas of weakness in your writing.
- Create a plan that minimizes possible writing weaknesses and presents new opportunities for expanding your professional writing skills.

2.2 ~ WARM-UP

Review your résumé/curriculum vitae (CV), and identify any experiences related to professional writing. Answer the following questions:

- In what ways are you demonstrating professional writing (e.g., journals, lay publications)? Were these experiences formal or informal?
- In what areas of professional writing are you limited?

2.3 ~ BACKGROUND

Writing across Multiple Venues

Within graduate school, writing occurs in multiple forms which might include writing journal articles, conference papers, and ultimately, a thesis or a dissertation. Although writing styles and expectations for each type of writing may differ, few students receive formal training about the differences of each style and the ways that they might need to develop as writers for each style. In addition, a common misconception among students is that they need to wait until they are well into their graduate programs before they can produce publications that are ready for dissemination across multiple audiences. Regardless of the occupational sector in which students will choose to work post-graduation, writing is an important skill.

Some of the differences in writing styles are found below.

Journal Articles

These papers are usually long and are collaborative in nature. While students might lead efforts on these papers, a faculty advisor or principal investigator (PI) usually provides direction and mentorship for these efforts. Data from a PI usually serves as the basis for the paper, and graduate students could be asked to assist with any aspect (e.g., writing or data analysis) of the paper. Most often, students are expected to conduct appropriate literature reviews

and complete any time-consuming tasks that might supplement other aspects of the paper.

The order of authorship on the paper might differ across disciplines. While first or sole authorship might be perceived to be more prestigious in certain fields, common practices might dictate that primary authors be listed last on a publication. Conversations such as this should be addressed *prior to* final publication. If a faculty researcher does not address this topic, graduate students might do so.

Conference Papers

Similar to journal articles, conference papers are usually peer-reviewed and multi-author papers. Since conference papers in many disciplines do not carry the prestige of journal papers, a general rule of thumb is to report trends and more general information in conference papers while placing in-depth, more comprehensive data within journal papers. If possible, discuss with your group how you will disseminate your research within a conference paper and within a journal paper. Having this conversation early focused your efforts and helps you to identify multiple ways that you want to present your research.

Thesis or Dissertation Writing

The thesis or dissertation is a book that reports original research findings of a graduate student. Consisting of multiple chapters that usually offer descriptions of pertinent literature, methods, results, and conclusions of research, the thesis is the culmination of years of graduate academic training. At this point, students are expected to become experts in their

research areas and to launch into the next phase of their professional careers. Although most dissertations remain unpublished, authors often extract portions of their dissertation for publication in peer-reviewed journals and proceedings.

Prior to completing the dissertation, it is helpful for authors to discuss with their advisors potential publication venues for the dissertation along with authorship concerns.

In addition, students are encouraged to engage in early conversations about who data belongs to, especially pertaining to thesis and/or dissertation publications.

Article Reviews

In addition to writing articles and paper, students might be asked to review a variety of papers and technical works. Such reviews are helpful, since they allow you to understand in depth the criteria for journal articles. If you are interested in publishing in a particular journal or presenting at a conference, you might want to identify ways to serve as a reviewer. General tips for completing journal articles include the following:

- Submit your reviews in a timely manner.
- Review journal criteria prior to completing your review, and align your feedback with the criteria that are set by the journal.
- Provide constructive feedback to the authors. Your tone should remain professional. Prior to submitting your feedback, reflect upon whether this review is one that would be helpful to

you if you were submitting a journal article.

- Note that you are one of several reviewers. For this reason, provide the most detailed feedback about content that is relevant to your area of expertise. If you are unsure about an element of the paper or if you would like to provide comments that you do not want to send directly to the authors, submit that information to the editor via a space provided in the review or via e-mail.
- Anonymity is key within the review process. Since you do not have to identify yourself within the review, be as honest as possible about strengths and weaknesses of the work that you are reviewing. This ensures that high quality reviews are an integral part of the review process.

Writing Strategies

Books and scholars recommend varying strategies for academic writing. Some say to pick a time and write 60 to 90 minutes every day. Others say to set aside a day in every week (e.g., every Thursday) and write for two hours. Although recommended strategies vary in suggested number of times and number of hours to write, the common theme across all reference is to persist and to not miss a scheduled writing time. The goal is to develop a writing habit.

Another strategy is to create a writing deadline. Unlike grant proposals or conference deadlines, journals usually do not specific deadlines for submitting manuscripts. For this reason, consider setting a publication schedule for paper submissions. Communicate and negotiate

your deadlines with co-authors. In this way, you are not stuck on writing endlessly. You also will have a completion date for your writing.

We recommend following strategies to help students begin and continue to write on a regular basis. We all have different times of the day when we are most prepared to write. For example, a morning person will be able to focus better in the mornings, so we suggest writing in the morning. However, there are times when our schedule does not allow us to work on our preferred time of the day. In this case, it is important to work around the schedule and find the time that best works for you. During this time, remove or turn off all distracters (phones, emails, etc.). Let others know that you have set aside time for your writing. You could do this by putting a sign on your door or letting your office colleagues know that you do not want to be distracted for certain period of time. Avoid being tempted to browse websites, and focus only on the writing task ahead. To ensure that you remain focused during this time, consider using a timer (several are located online) that allows you to stick to your scheduled writing time.

One of the biggest obstacles to writing is the notion that a document has to be perfect. For this reason many of us hesitate to write or type sentences in a document, and instead, think about writing and push back the writing to a later time. However, unless you are a linguist or a professional writer who has been trained to write for many years, many of us cannot create a perfect writing from the first draft. It is unfair to expect a perfect writing from the first draft. Good writing takes many weeks and even months.

Below are a couple of strategies to help you get started.

Strategy #1

We recommend outlining important ideas for the document. Then, begin to build on this idea by adding sentences. It is important to translate as much information as you can onto a document. Avoid judging the quality of your writing at this stage. Once you feel all the information is in the document, then begin to develop sentences and paragraphs. Check whether the sentences flow from one another and whether a paragraph conveys the ideas you want your readers to know. When you have written about a page, then begin to format, edit and proofread your writing. Sometimes you will want to add additional information or delete existing information. This will take multiple iterations. Once you are satisfied with your page, move on to the next page. Work on the second page as the way you did with your first page. Upon the completion of the second page, re-visit the first page. Reviewing the first page with a fresh set of eyes will help you see other mistakes or other ways to improve your document. As you know from your experiences, writing is an interactive process that takes time and effort, hence begin to write early when meeting your deadlines.

Strategy #2

Set your timer to write on a daily basis. Until you develop a substantive draft, write each day without editing in great detail. Just write. From an outline that you have developed, you might find yourself working on the literature review and the methods sections another day. Once you

identify a cohesive story, you can begin to edit or can pass the document on to co-authors, who can ensure that you don't ponder too long on the paper.

In summary, find a time that works best for you to write on a daily or weekly basis, commit to your writing schedule no matter what happens, avoid or minimize distractions as much as possible when writing, and take time to perfect your writing as this does not occur in your first, second or third drafts.

2.4 ~ EXPERIENTIAL EXERCISE

Create your own writing plan and schedule. Start small and then move forward with a more comprehensive plan. Identify two publications that you would like to develop within the next six months. For each publication, set a deadline for moving ahead, and create a general description of the publication, research questions, and/or data sources. Create and name actual files to represent these documents. Use the suggestions above to move forward with your writing plan.

2.5 ~ PROCESS

Identify 3 new writing strategies that align with your work preferences and schedule. What, if any, hindrances might prevent you from achieving these strategies? What might you do to remove those hindrances?

2.6 ~ CLOSURE

Practicing good writing habits takes time. If you don't achieve your writing goals immediately, do not beat yourself up.

Include others in your quest, and you will see success!

Additional References

Brent, R., & Felder, R. (1998). The New Faculty Member. *Chemical Engineering Education*, 32(3), 46-47. Retrieved from <http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Columns/Boice.html>

3 ~ RESEARCH GROUP DEVELOPMENT AND MANAGEMENT MODULE

Monica F. Cox

Module Overview: This module will discuss fundamental issues in creating your research group, identification of students to work in your group, management techniques for producing new ideas, and working with diverse students.

3.1 ~ SETTING THE CONTEXT

At the end of this module, students will be able to

- Develop a plan that establishes expectations, policies, and procedures for research groups that you may lead in the future.
- Identify your preferred research group management and leadership style.
- Create strategies for working with a research team representing diverse perspectives and preferences.
- Identify ways to align group dynamics while achieving project goals.

3.2 ~ WARM UP

You are the faculty advisor of a multicultural research group. The composition of the group is 5 graduate students (Corrine, Yi, Lavon, Jesse, and Mary) and an undergraduate student (Selena). The students vary in their work styles, academic backgrounds, skills, and work ethics. Descriptions of each student are found below.

- **Corrine** is in the final year of her doctoral program. She is a prolific researcher and publisher who prefers to work by herself on projects. She completes her work in a timely manner.

- **Yi** is a third-year doctoral student who is not very confident in her verbal and written abilities. She prefers to play supporting roles on all projects and only offers suggestions when asked.
- **Lavon** is a second year doctoral student who has a passion for service. He is an officer in three student organizations, and he serves as an informal mentor to numerous undergraduates on campus. It is sometimes difficult for Lavon to complete his research tasks in a timely manner because of his multiple commitments.
- **Jesse** is a second year doctoral student who likes order in every area of his life. He often organizes his life and tasks around spreadsheets, planners, and online organizational tools. He adheres closely to deadlines and becomes frustrated when others do not follow rules and procedures. He sometimes does not produce the most creative solutions to problems, since he likes to operate within known boundaries.
- **Mary** is a first year student who is a free spirit. She has a hard problem meeting deadlines, and she can disappear for days at a time without contacting her peers or advisor. She will often cancel meetings at the last minute because of illnesses and because she has lost files or deliverables that are valuable to the group.
- **Selena** is a junior who wants to learn more about research. She is anxious to help the group in any way that she can.

Think about your research style and preferences as you answer the following questions:

- What are the positive aspects of this group?
- What are the negative aspects of this group?
- How might your leadership style align or conflict with this group?
- What might you have to lead this group so that you promote their development while ensuring that you meet research goals?

3.3 ~ BACKGROUND

Although individuals might learn about research teams just from being members of them, it is ideal for students to think about their research group leadership and management style *prior to* leading a research group. Some of the decisions that a faculty advisor or research team leader might have to make include the meeting structure (formal and structured or informal, as-needed), mentoring practices (e.g., one-on-one or peer mentoring), individual and/or group evaluation processes, and the organization and/or reporting structure.

It is important to realize that there is not necessarily a right or a wrong way to structure a research group. Depending upon the composition of the group, you might have to make adjustments. For example, a group composed of postdoctoral researchers and senior graduate students may require a different management and leadership style than one comprised of mostly undergraduate students and first- and second-year graduate students. Other considerations might include variances in group

members' personalities, life experiences (e.g., nontraditional students), and cultural backgrounds. Depending upon this group composition, a research team leader might have to change his/her perspectives or preferred practices. The key is to reflect upon what is and is not working within the group and to make changes as needed.

Research team leaders should develop contingency plans, since life is unpredictable. A federal agency expects for researchers to meet prescribed goals, however, no matter what is happening in a single research group. People take medical leave, quit their jobs, and lose important information. It is up to the research leader to identify ways to archive information and to record the knowledge of research group members. One recommendation is to document all work that is occurring within a group so that others can quickly pick up where this person left off. A shared drive is also ideal in saving materials and sharing pertinent information without filling up one's e-mail inbox.

No matter how you manage the group, it is important to develop a plan. The remaining parts of this module provide advice about ways to develop a working research plan. This living document might change in the future, but you can rest easy knowing that you have thought about your research group philosophy prior to leading an actual group.

3.4 ~ EXPERIENTIAL EXERCISE

Read the excerpt of a sample memo provided for students in a research group. Highlight features that you think are particularly important when communicating expectations to members of your research group.

To: Cox Research Group
Re: Introduction and Expectations

My Background

I am glad that you are interested in working in the field of Engineering Education. I have prepared this document for students such as yourself to provide you some insight to my decision to pursue Engineering Education as a field of study, my philosophy on working with graduate students and my expectations on students working in my research group.

My interest in Engineering Education developed while I was a graduate student at the University of Alabama. It was here that I realized that many engineering faculty are not taught how to teach diverse learners. So, when I had an opportunity to pursue a Ph.D. in Industrial Engineering or a Ph.D. in an education-related discipline, I chose education. In 2000, however, there were no departments of engineering education.

The program that was most receptive to my passion for engineering education was Peabody College at Vanderbilt University's Department of Leadership, Policy, and Organizations. Within almost every course that I took at Peabody, I found a way to apply the current theory that I was studying to engineering education. In fact, by the end of my program, everyone knew that if I was writing a paper, it would automatically contain a reference to engineering education. Fortunately, Vanderbilt was also home to the \$17 million National Science Foundation-funded VaNTH Engineering Research Center for Bioengineering Educational Technologies (www.vanth.org). As a graduate student research, I interacted with national leaders in assessment and evaluation, learning science, learning technology, and bioengineering. By the end of my program, I was qualified to apply for an academic position within Purdue's new School of Engineering Education.

My Management Style

I believe that everyone has something to offer, and therefore my style of management is very participative. This means I empower you to take as much or as little responsibility for your progress as you would like. Simply, what this means is if you want to be here for a long time, fine, and if you want to be on the fast track, fine. It is not my job to be a roadblock to your end goal, but to champion you and your efforts and to assist you in completing your degree.

I like to set an overall direction and then let students decide the means to accomplish it. Also, I recognize that it is my responsibility to prepare you for the next level in life, whether that is an industrial position, a faculty position, or another job in your chosen field. I believe that you should leave this experience better than you started, and, if not better, at least greatly enhanced.

My Expectations of Graduate Students

I am not a micromanager, but I do believe in some fundamental rules. I expect you to stay current on the literature related to your interest and to share with me and/or the rest of the research group. As For all Ph.D. students, I expect that by your second year you would have published 1 peer-reviewed article or conference proceeding and to continue to do so annual until you graduate. Upon conclusion of your doctoral process, I expect that you will have at least one publishable article from your dissertation. I also expect you to be familiar with ENE policies and plan milestones as you conduct your research and/or teaching responsibilities.

My overall attitude is that you should become an expert in your area. That means you should know it inside and out. You should know more than I know and not be afraid to challenge me or anyone else based on your knowledge of the literature.

Although there are many models for working in graduate school, it is important to find what works best for you. At a minimum, I recommend that you adopt an 8-5 mentality. You will have an office, and you should be in it as much as possible. If you need resources, you should let me know. You should go to the library every once and awhile. You should not sit by waiting on me to tell you what to do. You should take ownership of your work.

Weekly Group Meetings & Project Assignments

I expect that you will attend weekly large group meetings. At these large group meetings, please be prepared to talk at least 10 minutes about what you and your group have done in the past week, what you plan to do during the next week, and what challenges you are facing with your project. You will be asked to provide this information via e-mail to the research group designee by 8 A.M. the morning of the research group meeting. The information that you present at the weekly large group meeting should reflect approximately 20 hours of work per full-time graduate student, 10 hours of work per half-time graduate student, and approximately 35-40 hours of work per full-time undergraduate student researcher. If you do not have enough work to do each week, please see me so that I can make adjustments to your assignments.

I have assigned students to projects based upon their skills, interests, and aptitude. Each person has been assigned a primary research project. Outside of the weekly large group meeting, it will be your responsibility to set up small group meetings with your subgroup. Primary researchers are responsible for keeping the groups on track, parsing out group assignments, submitting weekly reports on behalf of the group, and leading efforts on proceedings, publications, and proposal writing. Secondary researchers provide accountability to the group and provide research support as needed. Remember, you are a team, so each member of the team needs to have a role and a voice. I reserve the right to change assignments and roles if tasks are not being completed in a timely manner or at a level that meets my expectations.

Office Assignments

You will be assigned a designated space as needed. You will have total access to it. Make it your home away from home, but be respectful of those with whom you share resources.

3.5 ~ PROCESS

Write your own brief memo addressing the following: background information about yourself, your leadership and/or management style, your expectations for graduate students (e.g., hourly work schedule, assignments). Also, create a sample set of assessment questions that will provide your students with feedback about their progress within your research group. A guide for thinking about you management style may be found in the reference Goulde (2001).

3.6 ~ CLOSURE

Now that you've had an opportunity to engage reflect upon your personal research group philosophy, identify areas where you still have concerns or questions regarding research group management. Make a list of 2-3 resources that might help you to continue in your exploration of research group management. Initial topics that you might explore relate to team dynamics and assessment.

References

Golde, C. (2001). Section Three: Questions to ask to help select an advisor. In *Questions to ask when thinking about pursuing a Ph.D.* Retrieved from <http://www.phd-survey.org/advice/Advice%20-%20section%20three.htm>

Additional References

Fong, B.L., & Hansen, D.B. (2012) Engaging research groups: rethinking information literacy for graduate students. *Issues in Science and Technology Librarianship*, 71. doi: 10.5062/F4V122Q6

Sarkisan, E. (1997). Working in Groups – a note to faculty and a quick guide for students. Retrieved from <http://isites.harvard.edu/fs/html/icb.topic58474/wigintro.html>

4 ~ PROJECT MANAGEMENT AND BUDGETING MODULE

Monica F. Cox

Module Overview: This module will introduce students to basic project management and budgeting. A focus will be made on managing multiple projects and fulfilling requirements of funding agencies and other stakeholders (e.g., graduate students and faculty).

4.1 ~ SETTING THE CONTEXT

At the end of this module, students will be able to

- Identify basic project management techniques that will be beneficial in future projects, particularly those involving students.
- Align project goals and outcomes to a project's budget.
- Assess current project manager strength and weaknesses
- Create strategies for becoming a better project manager

4.2 ~ WARM UP

As a graduate student, you are expected to juggle numerous projects simultaneously. Suppose that you are given the following assignments as the student leader of a research group.

(1) Outline and submit a two page abstract of your current research project. Data are analyzed, but you need to finish a literature review and communicate the tasks that you need to be completed by other team members. The abstract deadline is in two weeks.

(2) Prepare for your preliminary defense, which is 2 months away. You need to review materials from past courses, and you need to compile your notes in a meaningful way so that you will be ready

to complete your exam in a timely manner and recall information quickly.

(3) You mentor two undergraduate student researchers in your group. They are just beginning an eight-week research experience, and your job as the lead student researcher is to provide mentoring plans that will be available for review by your advisor at the end of the week.

How do you manage these responsibilities successfully? Where do you start?

4.3 ~ BACKGROUND

Graduate school differs from faculty life or from life as a leader in industry in several ways. First, unlike graduate school, you do not have the luxury (Yes, luxury!) of working on a singular research project. By the end of your graduate career, the dissertation is usually your sole project, and you are so deeply immersed in it that that you may not demonstrate breadth. In addition, graduate students often do not have to engage in high-level research, teaching, and service simultaneously. If this does occur, graduate students are not leading large research groups, teaching and grading course work, and serving on numerous committees.

Good project management could be the difference between earning tenure, obtaining a large grant, or graduating a student in a timely manner. Each person must realize his/her capacity without sacrificing the members of a research team.

Budgeting

Budgeting for research projects is very similar to managing your personal finances. Let's start with some basic principles. First, don't spend more than you have in your account, and second, don't spend money on illegal goods.

Budgets are either given to you or you have to create a budget for your project. If a budget has already been given to you and funding allocations assigned to various categories for a project, then your job is to *manage* the funds in an appropriate way. If you are working on a new project, and someone is asking you to create a funding request to complete the work, your role is to *align* your project goals with the requested funds. Strategies for working with both scenarios are provided in the next section.

Working with a Preset Budget

To some extent, having a preset budget gives you an opportunity to manage resources in a thoughtful way. First steps are to understand the allocations that have been prescribed and to note the constraints and/or rules for spending funds within each category or "line." For example, a category called "supplies and expenses" might allow you to buy office supplies such as pens and paper but not laptop computers. Such rules might vary by the funding sources. It is your job as project manager to understand these funds prior to spending money or committing funds to other stakeholders in your organization.

Two complications that might occur when working with preset budgets is overspending and underspending. If your project has an end date, it is the

responsibility of the project management to ensure that funds will be distributed appropriately before the end of this period. Overspending might mean that your organization has to use other funds to pay for extra expenses not covered within the project. Underspending funds awarded from federal agencies might mean that the money is returned to the government. If a project manager anticipates that funds will not be spent by the end of the project period, it is his/her responsibility to inform the funding agent to determine if an extension can be given or to see if funds might be reallocated to other aspects of the project. Communication is key no matter what the scenario.

Developing a Project Budget

It can be daunting to create a project budget from scratch. First, think about the project that you want to conduct along with the scope of this project. In other words, who will be the stakeholders in your project? How do the goals, objectives, and budget needs align?

Common mistakes that novice project managers often make are overestimating or underestimating the financial needs within a project. If a funding agency asks you to submit a \$200,000 budget to conduct work among a group of students at one university, you have to think about what you need to do the work effectively. If this will take a portion of your time, then you need to budget time to "buy" some of your time from other projects or obligations. Since you will not be the only person working on the project, you might want to budget in support to fund a graduate student or postdoctoral researcher. You will continue to identify your needs based upon the type of work

that you do and the extent to which you want to do this.

As a project manager, you also want to create a timeline for completing the work. If you have two years to complete the project, do you need to allocate money to travel to conferences or meetings annually? Do you need to travel to another location to conduct research after a year? These details can be checked with your budget as well.

Finally, it is important to identify the business and financial professionals who can guide you when you have questions about managing your budget. These individuals are often most familiar with funding rules, overhead or indirect costs (i.e., extra money allocated to cover standard expenses at your organization), or procedures for reporting updates or changes in your project or budget.

4.4 ~ EXPERIENTIAL EXERCISE

Read the document from The University of Georgia Graduate School (Hill, J., 2005, pp. 1-2) (See the link in the References portion of the module.)

Think about a research-affiliated project that you have to work on. This might be your dissertation or a smaller research study. Using the ten steps presented within the reading, identify how you might manage the project that you have selected.

Process

Which of the steps outlined within your plan to you think will be the easiest to achieve? Which steps are most difficult? What might you do minimize the difficulties that might occur within your

project? What additional skills do you need to develop to achieve your desired plans?

4.5 ~ CLOSURE

Now that you have drafted a plan for engaging in project management, show your plan to your advisor. Offer to assist with the development of budgets for an upcoming grant or project.

References

Hill, J. (2005). You're in charge: project management for graduate students. *The 5 minute mentor: quick tips for student success from the graduate school*, 2, 2, 1-2. Retrieved from http://www.grad.uga.edu/forms&publications/5MM/5minute_v2n2_0405.pdf

Additional References

Project Management Institute (2000). A guide to the project management body of knowledge. Retrieved from http://www.ucongreso.edu.ar/grado/carreras/lsi/2005/dir_proyec/pmbok_2000.pdf

5 ~ COMMUNICATION MODULE

Monica F. Cox and Tasha Zephirin

Module Overview: Graduate school prepares students to be experts in their technical areas. Professionals who hire such graduates, however, expect students to be able to communicate their ideas to audiences that often are not from technical backgrounds. This module will offer students strategies for communicating clearly across multiple settings.

5.1 ~ SETTING THE CONTEXT

At the end of this module, you should be able to

- Translate knowledge, skills and insights from technical research to formal and informal learning environments
- Tailor communication of technical content to selected audiences

5.2 ~ WARM UP

You have five minutes each to present your technical research project to (1) a middle school student who is excellent at math, (2) a Nobel Prize winner whose research expertise is in inorganic chemistry, and (3) the First Lady of the United States.

How would your communication strategies be *similar* across individuals? How would your communication strategies *differ* across these individuals?

5.3 ~ BACKGROUND

One way to eliminate any communication gaps between technical and nontechnical groups is to know your style of communication, to identify the communication styles of those with whom you are working, and to then bridge any communication gaps between the two groups. A few tips for communicating among technical and nontechnical audiences are found below.

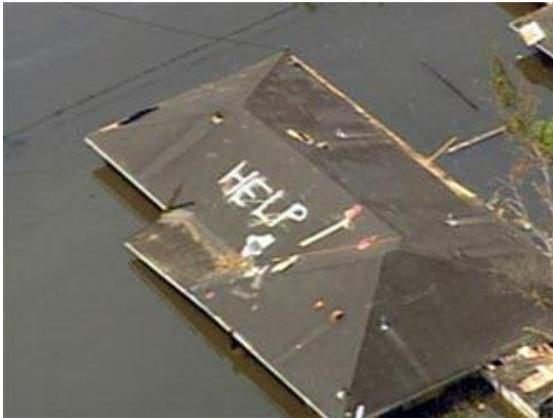
(1) *Establish a common vocabulary.* When working with nontechnical audiences or people who might not be familiar with your work, it is beneficial to define terms that might have multiple meanings across a variety of contexts. As a technical expert, you might not only define terms but provide examples of these terms so that others are comfortable engaging in conversations with you.

(2) *Listen with understanding.* Instead of seeing yourself as the person with all the answers, consider that others might have ideas that can add value to your work. A person without your technical expertise may not have the technical vocabulary of an expert, but they might offer some helpful suggestions for moving ahead with your research. Approach your conversations with an open mind and do not dominate a discussion. You might learn more than you expected.

(3) *Monitor your body language.* Your actions speak as loud as your words. To avoid misunderstandings in perceptions, maintain an even voice when speaking and offer neutral stances when presenting information to multiple audiences. Such neutrality may open doors for others to receive the messages that you are trying to present to them.

5.4 ~ EXPERIENTIAL EXERCISE

In August 2005, Hurricane Katrina devastated New Orleans, Louisiana. Because the levees were compromised, an estimated \$50 billion of damage occurred, up to 1,577 people were killed, and over 283,300 people were displaced (Knabb, Rhome, & Brown, 2011; Geaghan, 2011).



*New Orleans Home after Katrina
Photo Courtesy of Google Images*

How could you, as a technical expert, communicate to a variety of audiences the potential consequences of an action (e.g., not repairing levees?)

How do you communicate when you don't have a positive message for your audience?

5.5 ~ PROCESS

What are possible consequences of ineffective communication during your graduate education experience? What are the potential consequences of not communicating your research effectively?

5.6 ~ CLOSURE

Now that you have thought about your communication style and preferences, make a list of 3-5 areas where you would like to improve your communication along with definite steps that you will make to improve your communication.

References

Knabb, R., Rhome, J., & Brown, D. (2011). Tropical cyclone report: hurricane Katrina. Retrieved from http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf

Geaghan, K. (2011). Forced to move: an analysis of hurricane Katrina Movers. Retrieved from http://www.census.gov/hhes/www/hlthins/publications/HK_Movers-FINAL.pdf

6 ~ LEADERSHIP MODULE

Monica F. Cox and Benjamin Ahn

Module Overview- This module will help students to identify ways that they can engage in leadership experiences and become effective leaders in a variety of environments. Students will learn how to balance their graduate responsibilities and pursue strategic leadership opportunities that will align with their personal and professional goals and objectives.

6.1 ~ SETTING THE CONTEXT

Leadership is often associated with disciplines such as business and management and is rarely offered explicitly in science, technology, engineering, and mathematics- (STEM) related courses. Numerous studies, however, at both the undergraduate and graduate level identify a need for STEM students to engage in professional skills such as leadership, because, upon graduation, these students are expected to be experts in their domains *and* to lead people from diverse backgrounds in nontechnical and technical ways.

In response to increased interests by government, industrial, and academic stakeholders in the development of leadership skills among STEM students, particularly those in engineering, this module will allow students to self-reflect upon their personal leadership experiences and upon ways that they can enhance these leadership abilities. Students will learn how to balance their graduate responsibilities and pursue strategic leadership opportunities that

will align with their personal and professional goals and objectives.

By the end of this module, you should be able to

- Identify the characteristics of effective leadership.
- Self-reflect upon personal leadership qualities.
- Identify ways to incorporate leadership principles into current graduate activities.
- Determine the role(s) of leadership in future career objectives and activities.

6.2 ~ WARM-UP (2 MINUTES EACH)

- Define leadership.
- Describe the role(s) of leadership in the life of a graduate student.
- List the names of five people who you consider to be leaders, and describe why you consider these people to be leaders.
- Identify your personal traits that align or do not align with positive characteristics of leadership.

6.3 ~ BACKGROUND

A recent mixed-methods study conducted by the authors' research team has found three major leadership components that engineering professionals think engineering students should possess upon graduation: (1) being goal oriented, (2) possessing personal attributes that promote member inclusion, and (3) being technically competent (publication under

review). Although this study was conducted among engineering students and there are numerous aspects of leadership that are applicable to graduate students, these traits are still applicable to wider audiences and are presented in more detail below.

The first component, “*being goal oriented*”, is a leader’s ability to organize and allocate important resources to accomplish individual or team goals. Goals could include solving problems, developing new opportunities, making important project-related decisions, or sharing knowledge. The desire to accomplish goals is a driving factor and provides insight about where and how engineering leaders find and allocate project resources.

As a graduate student, identification of goals is vital. These goals could relate to a variety of activities such as publishing, conducting research, or attending professional development workshops. Both short-term (e.g., 3 months, 1 year) and long-term goals (e.g., 5 years) should be determined. Once you have identified such goals, you can identify others who will be a part of your mission toward achieving these goals and can begin to develop a plan that moves you close to achieving those goals.

The second component of an engineering leader is the ability to *include all members in a team*. The ability to include all members include treating peers with respect and dignity, listening to peers’ concerns and opinions, fulfilling his or her responsibilities to the team, or taking opinions of other members when making decisions. A good leader will try to find

ways to include all project members or stakeholders on a project and will maximize the strengths of the members of the team.

Graduate students have opportunities to demonstrate inclusivity in several ways (e.g., mentoring an undergraduate student researcher or leading a research team). Strategies for identifying the strengths and the weaknesses of your team members might include conducting one-on-one interviews with members of your team or conducting a strengths or skills assessment (many of these are found on the Internet). Once you have done this, you can identify ways that members of your team might work together to accomplish common goals that have been set by your team.

The third component is *technical competence*. Technical competence not only includes being familiar with fundamental knowledge, literature, or technology, but also includes the ability to communicate your technical results to others. This includes explaining and discussing the technical elements of a project with other team members as well as explaining technical matters to people who are not familiar with the project (e.g., customers, business officers etc.). For graduate students, this means that it’s important to possess depth and breadth (i.e., be a technical expert while also recognizing that your work should be understood by others outside of your technical community).

6.4 ~ EXPERIENTIAL EXERCISE

The topic of leadership will be addressed in scenarios that are presented later in this module. After each scenario, you will be asked questions in which you must consider your role as a faculty leader to students on both teams. Draw upon your past experiences and upon content above as you think about your responses for each scenario.

Scenario 1: “Assuming Leadership on a Student Team”*

Two weeks after the semester has started, you (a faculty member) realize that one of your student design teams consists of all members who have not had much leadership experience. For this reason, no student member wants to be the chairperson or the secretary, roles that are integral to the success of the team. Even when students on this team assume leadership roles, they experience difficulty making any decisions related to the progress of a project goal. The students are clearly not comfortable with taking responsibility and making final decisions that could impact the group and the overall success of the project.

- (1) Have you ever experienced a situation like this? If so, what role(s) did you play in this scenario, and what were the outcomes of the situation?
- (2) What can you do as a faculty member when this kind of situation arises?
- (3) Assume that the composition of the team consisted of two international students (i.e., a Chinese female, a Korean male, a U.S.-born white female, and a Hispanic male). Would you handle the situation differently? Why or why not?

Scenario 2: “Everyone’s a Leader”*

You notice in your class that there is a team where everyone wants to be the leader, wants to take on responsibility, and wants to make the final decision with respect to all aspects of the design project (including the design, cost, building, presenting, and talking to sponsors). All members in this team strive to be the leader who has the right and the ability to take control of the team and to guide the team throughout the semester. As a faculty member, you recognize that the person assigned to be the chairperson in this team is dictating and is not willing to listen to others. The situation further deteriorates, as most of the students in this team are “natural leaders” who are not afraid to voice their opinions.

- (1) Have you ever experienced a situation like this? If so, what role(s) did you play in this scenario, and what were the outcomes of the situation?
- (2) What can you do in this type of situation?
- (3) How would you encourage students to demonstrate positive leadership characteristics in this situation?

*These cases were developed primarily by Benjamin Ahn, a doctoral student in the School of Engineering Education at Purdue. Funds to support this work were provided by a seed grant from the Purdue College of Engineering.

6.5 ~ PROCESS

In what ways did you respond similarly or different across scenarios? What other scenarios might you encounter as a leader in academic and nonacademic settings?

Identify 3-5 things that you might do in your current graduate studies to prepare you to lead others in academic and nonacademic settings. Share these thoughts with a neighbor, and add to your original list as necessary.

How might you improve your leadership skills? Provide action plans that you would perform to help improve your skills. State how you think your action plans can help improve leadership skills.

6.6 ~ CLOSURE

Has your definition of leadership changed from the original definition that you wrote? Why or why not?

7 ~ SCHOLARSHIP OF TEACHING AND LEARNING MODULE

Monica F. Cox and Jiabin Zhu

Module Overview: This module will provide students with strategies for integrating research, teaching, and service activities in the development of a professional portfolio of activities. This module also identifies ways to prioritize activities within one's professional career and to turn everyday activities into scholarly work.

7.1 ~ SETTING THE CONTEXT

At the end of this module, students will be able to

- Identify connections between technical research activities and the scholarship of teaching and learning.

7.2 ~ WARM UP

Think of a class that you have taught or would like to teach in the future. Identify ways that you can present information from that class to colleagues or to others who might be interested in learning about your course innovations.

- How could you present this information in a way that aligns with traditional faculty expectations of scholarship (e.g., writing journal papers or presenting your work within invited talks)?
- What are other ways that you might link your teaching to research?

7.3 ~ BACKGROUND

In "Scholarship Reconsidered", Ernest Boyer (1990) defined four forms of scholarship: the Scholarship of Discovery,

the Scholarship of Integration, the Scholarship of Application, and the Scholarship of Teaching. The Scholarship of Teaching starts with professors who are "well informed" and "intellectually engaged" (p.23). It also requires the "pedagogical procedures" to be "carefully planned, continuously examined" and to "relate directly to the subject taught" (p.24). With the Scholarship of Teaching, a professor not only "transmits" knowledge, but also "transforms" and "extends" knowledge (p.24).

The later discussions inspired by Boyer's work have allowed a deep understanding about the Scholarship of Teaching and Learning and about ways to develop this scholarship. As Gale and Golde (2004) defined, "the scholarship of teaching and learning is a rigorous investigation into classroom practice, how a teacher teaches, and how (and what) students learn." In their article, practical steps were proposed for graduate students to gain exposure to the Scholarship of Teaching and Learning and to develop this scholarship.

Their article about doctoral education and the scholarship of teaching and learning can be found in Gale & Golde (2004).

It is important to identify ways that the traditional activities that you engage in within academia (i.e., teaching, research, and service) align with the scholarship of teaching and learning (SoTL), which result in scholarly deliverables (e.g., publications) that are produced as a result of innovations in teaching. To accomplish this goal, you need to be

strategic when planning daily activities of your teaching, research, and service.

Being conscious of connecting teaching with your research includes two major directions. One way is to implement the latest research findings in education or within specific fields into your classes. These research findings may cover topics

such as the organization of learning activities, the interactions between teachers and students or among students, the organization of course materials, and the design of assessment tasks for students' knowledge and skills.

Table 1 – Sample Scholarship of Teaching and Learning Journals across Disciplines

CHEMISTRY	ENGINEERING	ENGLISH	HISTORY	MATHEMATICS	PHYSICS	TECHNOLOGY
Journal of Chemical Education	Journal of Engineering Education	English Education	The History Teacher	Research in Science Education	Journal of Research in Science Teaching	Journal of Technology Education
				Journal of Mathematics Teacher Education	Physical Review: Physics Education Research	
Chemistry Education Research and Practice	Advances in Engineering Education	International Journal of English and Education	Teaching History (US)	Educational Studies in Mathematics	Physic Teacher Research in Science Education	Journal of Science Education and Technology

As you are incorporating the latest educational innovations into your classrooms, it is important to note the impact of these innovations on your students' learning. Before disseminating educational innovations, choose your methods of assessment and evaluation. Books such as Bransford, Brown, and Cocking's (1999) *How People Learn* and Wiggins and McTighe's (2001) *Understanding By Design* are two excellent references for beginning this exploration. With these texts, you might

identify ways to link goals and outcomes to assessments and course activities, which may ultimately translate into publications. Although there are general venues for publishing articles within the scholarship of teaching and learning (e.g., the *International Journal of Scholarship and Learning*), be aware of different venues in your disciplines that publish the scholarship of teaching and learning. Here are some sample publications venues for several sample disciplines.

Additional Tips

Faculty members often have limited time to prepare lessons and engage in quality research activities. In preparation for engaging in the scholarship of teaching and learning, consider the tips below.

- Do not be a control freak. Delegate!— A common mistake is to spend the majority of your time on teaching activities in an effort to be the “perfect” teacher. If you have a teaching assistant, think about how this assistant might help you early in the process. Such delegation will allow you to maximize the talents of your assistant and your time.
- Identify creative ways to engage students and to assess them.
- Make notes/lesson plans so that you do not have to replicate efforts in the future. At the end of the term, reflect on what went well, and what did not go well.
- Engage in the scholarship of teaching (Boyer). Publications about your teaching efforts can count toward promotion and tenure.

It is also helpful to make full use of resources around you. Seek out resources that would facilitate your development of the scholarship of teaching and learning. These resources can include workshops/courses focused on preparing future faculty, teaching and learning centers that offer training programs for improving your teaching practices, or professors in your department who have demonstrated a strong emphasis of the scholarship of teaching and learning in their own research and teaching practices.

7.4 ~ EXPERIENTIAL EXERCISE

1. List the journals or conferences that are possible venues in your discipline for publishing scholarly articles.
2. List 3-5 teaching or learning techniques that you would like to implement in your daily scholarly experiences.

7.5 ~ PROCESS

Corresponding to the four steps (exposure, encounter, engagement, and extension) for training graduate students in Gale and Golde (2004), what are the opportunities/ resources that you could potentially use in each step to develop the Scholarship of Teaching and Learning?

7.6 ~ CLOSURE

Peruse the additional resources below and identify 3 ways to incorporate the Scholarship of Teaching and Learning into your future career plans.

The New Faculty Member by Brent and Felder (1998).

This website provides a useful toolkit to support scholarly activity (Scholarly Activity Toolkit, 2005).

References

Boyer, E. (1990) *Scholarship Reconsidered: Priorities of the Professoriate*. Princeton, N.J.: Carnegie Foundation for the Advancement of Teaching

Bransford, J.D., Brown, A.L., & Cocking, R.R. (Eds.) (1999). *How people learn: brain, mind, experience, and school*. Washington, D.C.: National Academy Press.

Gale, R. & Golde, C. (2004). Doctoral education and the scholarship of teaching and learning. *Association of American colleges and universities PeerReview*. Retrieved from <http://www.aacu.org/peerreview/pr-sp04/pr-sp04feature2.pdf>

Wiggins, G., & McTighe, J. (2001). *Understanding by Design*. 2nd Edition. Alexandria, V.A.: Association for Supervision and Curriculum Development.

Additional References

Brent, R. & Felder, R. (1998). The new faculty member. *Chemical Engineering Education*, 32(3), 46-47.

Scholarly Activity Toolkit (2005). UPC Staff Resources, Retrieved from <http://www.help-cetl.ac.uk/upc/scholarly/>

8 ~ DIVERSITY MODULE

Monica F. Cox

Module Overview: This module will provide students with strategies for being successful as minorities in majority environments. Among the areas of emphasis include pioneerism, isolation, and marginalization.

8.1 ~ SETTING THE CONTEXT

Although many underrepresented minority students are taught to become excellent academicians, they are often not exposed to ways that they can navigate academia as an underrepresented minority. For this reason, at the end of this module, students should be able to

- Identify strategies to overcome issues traditionally encountered by underrepresented minorities in science, technology, engineering, and mathematics (STEM).
- Create personal strategies to address issues of diversity in one's future academic careers.

8.2 ~ WARM-UP

What, if any, concerns do you have about being a minority within your graduate program?

If you are not a minority, what concerns do you perceive that someone might have in an environment in which he/she is not a member of a dominant group?

In either scenario, what are proposed strategies for engaging diverse groups in conversations about inclusion?

8.3 ~ BACKGROUND

According to numerous U.S. reports, minorities and women make up relatively small numbers of students enrolled in science and engineering (S&E) degree programs. This percentage has remained relatively flat over time.

Given these numbers, it is likely that minorities will be underrepresented within a department or at a university. Among the issues that students might face include pioneerism, isolation, and marginalization (Stanley, 2006). Overviews of each along with examples follow.

Pioneerism refers to being the first one to do something. This might relate to being one of the first students of color to study within a particular specialization or research lab. One of the problems with pioneerism is that students might have to educate others about other cultures while obtaining a degree within an area that requires much dedication and/or concentration.

Be patient with others if they ask questions that are somewhat offensive about your culture or about your cultural practices. Turn this into an opportunity to educate someone about your culture and to have conversations about ways that diverse issues might be addressed within a higher education environment.

Isolation refers to your not being included into the fabric of an organization or being on the periphery of a situation. Many times, this might lead to attrition within

graduate education or to negative experiences.

Instead of seeing isolation as a negative issue, see this as a time to be proactive. To be successful in graduate school, sitting by alone in a corner is not an option. Rather than feeling that you have no people to relate you, consider inviting yourself to groups or seeking out others with similar interests or characteristics. If you are an introvert, find a small group of people with whom you can engage. These initial connections might occur over coffee or lunch. If you are an extrovert, consider hosting or co-hosting an event for members of your research group or your department. Plan a few activities that provide you with opportunities to let others get to know you and vice versa.

Marginalization refers to the fact that others may consider minorities to perform at a lower level than others. This might result in people assuming that you don't possess particular skills or that you do not perform at the same level of peers who might be of a majority group or of a group that has traditionally been known to perform at high levels in science and engineering.

You must realize that you cannot change others views of you. You must not, however, allow others to hinder you in your pursuit of a graduate degree. The fact is that you are in graduate school to learn, so if you don't possess certain skills, this is natural. Ask questions to those who have the answers and seek knowledge so that you can present yourself in the most positive light. It is also important to remember that you do not represent every member of your ethnic group, so you should not place extra

pressure on yourself to speak for every minority.

8.4 ~ EXPERIENTIAL EXERCISE

Scenario

You live in a college community with a 10% underrepresented minority population. Although the university within this community has a few cultural centers on campus that provide academic-year activities for students, there is not an abundance of formal activities in which you can engage with other minority graduate students. You have a minimum of two years to spend in this community, and you are not sure how you are going to have a prosperous social life and a productive research life at the university. What do you do?

8.5 ~ PROCESS

Although each person's experience differs, it is helpful to identify strategies (e.g., creation of mentoring networks) that might provide you with positive tools for advancing in environments in which you are underrepresented.

In addition to the topics presented here, consider other concerns that you have about moving to the next level of your career as a professor or STEM professional. If and when these challenges arise, return to the suggestions in this module and to other resources that are readily available on the Internet or in your place of employment.

8.6 ~ CLOSURE

What are possible strategies for overcoming issues of isolation within your current and/or future environment?

What are possible strategies for overcoming issues of pioneerism within your current and/or future environment?

Universities. Retrieved from http://www.aacu.org/inclusive_excellence/documents/Milem_et_al.pdf

Ryan, T. (n.d.). 5 strategies for dealing with diversity in the workplace. *Small Business by Demand Media*. Retrieved from <http://smallbusiness.chron.com/5-strategies-dealing-diversity-workplace-18106.html>

References

Stanley, C.A. (2006). *Faculty of color: Teaching in predominantly white colleges and universities*. Boston, M.A.: Anker Publishing Company.

Additional References

Gender and Diversity Issues (2010). Stanford Graduate School of Business. Retrieved from <http://www.gsb.stanford.edu/news/research/podgender.shtml>

Hyman, J.S., & Jacobs, L.F. (2009). Why does diversity matter at college anyway? *US News & World Report Education Professors' Guide*. Retrieved from <http://www.usnews.com/education/blogs/professors-guide/2009/08/12/why-does-diversity-matter-at-college-anyway>

Milem, J.F., Chang, M.J., & Antonio, A.L. (2005). Making diversity work on campus: a research-based perspective. *Association of American Colleges and*

9 ~ MENTORING MODULE

Monica F. Cox and Jiabin Zhu

Module Overview- This module will help students to create mentoring networks and to identify ways that they can become effective mentors to others. Students will learn how to balance mentoring and service responsibilities with other professional responsibilities (e.g., conducting research and publishing) along with ways to identify mentors who can help them to achieve their personal and professional goals.

9.1 ~ SETTING THE CONTEXT

In response to the challenges facing graduate students and considering the multiple advantages of a beneficial mentoring relationship, this module will implement elements that will improve graduate students' academic experiences. It will incorporate materials that were informed by empirical research that utilizes qualitative and quantitative methods. The purpose of the workshops will be to promote mentoring relationship between faculty members and graduate students at Purdue University, and they are expected to improve graduate students' academic lives by helping to increase the retention and degree completion rates of these students.

By the end of this module, you should be able to

- Identify the roles and responsibilities of mentors
- Develop mentoring skills, strategies, and networks

- Identify appropriate mentors based upon personal and professional objectives
- Distinguish between positive and negative mentoring relationships
- Identify ways to effectively mentor others
- Balance mentoring and service responsibilities with other professional responsibilities (e.g., conducting research and publishing)

Warm Up (3 minutes each)

- Define mentoring.
- Describe the benefits of mentoring or the roles of mentors.
- List the names of five past and/or present mentors, and identify the positive characteristics of these mentors.
- Identify the positive characteristics of good mentees.

9.2 ~ BACKGROUND

The Basics of Mentoring

Remember your Math—Mentors Add and Multiply

Mentors should *add value* to your life and should to provide you with tools that allow you to *multiply* your efforts. The values that are added to your life by your mentors may be determined by your priorities and goals or what you deem to

be important at a particular time in your life. When you obtain the information, knowledge, and skills that you are supposed to obtain from your mentor, you will be able to prosper and may pass this information, skills, and knowledge on to others who might seek you to be their mentor. Depending upon what you need at the time, a mentor may serve as a role model, a teacher, an advisor, or a confidant. This mentor might advise you on a one-time event or he/she may remain in your life throughout your academic or professional career. A mentor may eventually become a personal friend or someone with who you share information about your personal life and beliefs.

A mentor should not subtract from your value or cause division in your life. A mentor should not tear you down with words that make you doubt who you are as a person or your overall purpose in life. Such blatant negativity differs from constructive criticism, in which a mentor may provide you with feedback that can help you to eliminate bad habits or to change incorrect thinking about a topic. You can identify if feedback is meant to be constructive depending upon the mentor's motives. If your mentor wants you to overcome a problem, it is probably best for you to receive this feedback and work with you mentor to identify ways to overcome your limitations.

Mirror, Mirror on the Wall

A mentor does not have to look or act like you. Mentors may be of a different gender, race, religion, etc. Do not limit yourself to a mentor with whom you

would automatically connect. Within a professional or academic environment, a mentor might be someone who embodies characteristics that you admire or hope to acquire (e.g., possess a strong work ethic or savvy networking skills). A mentor also could be someone who has achieved goals that you one day hope to achieve (e.g., become a member of the National Academy of Engineering or own your own consulting firm). Particularly for individuals entering environments in which they are the first or only person of their kind, it is important to connect with members of a majority group in an effort to understand cultural or social norms within an environment that may not have been navigated previously by underrepresented groups.

May I Have Your Number?

Once you have created a list of possible mentors based upon the characteristics that you have identified, set up a time to talk or to meet with your potential mentor(s). Prior to this meeting, reflect upon the reasons that you want this person to mentor you. During the initial meeting with your potential mentor, tell this person why you have selected him/her to serve as your mentor. For example, if you are seeking a mentor who conducts high quality academic work and owns a start-up company based upon this work, you might mention that you have read several of her papers (Actually read them before the meeting!) and that you are interested in conducting similar research and learning how to create a successful start-up in the future that can

produce high quality work similar to the work produced by her group.

At this point, a mentor can say that he/she would be honored to work with you or that he/she has no time to mentor you. If he/she agrees to meet with you, it is your responsibility to be proactive and to work with your mentor to minimize inconveniences to his/her schedule. Work with your mentor or with his/her assistant to establish times to talk or meet. As a courtesy to your mentor, come to your mentoring meeting prepared and with a clear idea about what you want to talk about that day. Ask mentors about possible expectations that they have of you. For example, if your mentor prefers to receive a formal agenda prior to that meeting, make sure that you create one and send it to him/her prior to the meeting. At the beginning of the meeting, discuss with your mentor how you acted upon the suggestions or advice that he/she offered you in a previous meeting. (Nothing expresses your appreciation to your mentor as when act upon his/her advice.)

The frequency in which you meet with your mentor can be determined by the two of you given your schedules, although it is best to ask your mentor about his/her availability to meet. Rather than meeting, some mentors prefer that you call them on an “as-needed” basis (i.e., when an issue comes up about which you need advice.). If a mentor says that you can just call him/her when such a need arises, remember that you still need to respect his/her time by asking pertinent questions that reflect the seriousness in which you review this relationship. No

matter how often he/she agrees to meet, respect his/her time.

If a potential mentor does not express interest in working with you, or if you do not think that your initial meeting with a potential mentor went well, do not fret. Retain the list of characteristics that are important to you in a mentor, and identify others who possess similar characteristics. Proactivity is key when establishing and maintaining a positive mentoring relationship.

Pay It Forward

Once you have engaged in a positive mentee-mentor relationship, others might begin to ask you to serve as a mentor. If someone asks you to mentor them while you are still a graduate student, it is vital for you to not overextend yourself as a mentor. Service is very important, particularly to women and underrepresented students. As a result, it is vital to guard your time and to identify if (1) you have adequate time to devote to mentoring others, (2) your mentor-mentee relationship could be a mutually beneficial one (e.g., this could turn into a future research collaboration), and (3) this relationship could offer potential training for your future career (e.g., advising graduate students as a professor). If you choose to pursue such a relationship with a mentee, self-reflect upon your personal strengths and weaknesses so that you can grow as a mentor and provide new insight to future mentees.

9.3 ~ EXPERIENTIAL EXERCISE

Please read the following article by Terri Givens (2009), "The Importance of Mentors."

1. What were the roles and responsibilities of mentors in the author's life?
2. What were the positive characteristics of the mentors in this article?

9.4 ~ CLOSURE

Write the names of 3-5 potential mentors and their current or potential roles in your life.

Mentor 1 _____

Contact Information _____

Role(s):

Mentor 2 _____

Contact Information _____

Role(s):

Mentor 3 _____

Contact Information _____

Role(s):

Mentor 4 _____

Contact Information _____

Role(s):

Mentor 5 _____

Contact Information _____

Role(s):

References

Givens, T. (2009) The importance of mentors. *Inside Higher Ed*

Additional References

Austin, A.E. (2002), "Preparing the next generation of faculty: graduate school as socialization for the academic career", *Journal of Higher Education*, 73, 94-122.

Bell-Ellison. B., & Detric, R. F. (2008). What do graduate students value in their ideal mentor? *Research in Higher Education*, 49, 555-567.

Cox, M.F., Zhu, J, Cekic, O, Chavela, R, & London, J. (2010). Knowledge or feelings: first-year students' perceptions of graduate teaching assistants in engineering. *The Journal of Faculty Development*, 24, 27-34.

Durkin, K., & Main, A. (2002). Discipline-based study skills support for first year undergraduate students. *The Institute for Learning and Teaching in Higher Education and SAGE publications*, 3, 24-39.

Johnson, W.B., & Huwe, J.M. (2003). *Getting mentored in graduate school*. Washington, D.C.: American Psychological Association.