Running a Productive Lab with Graduate Students

Having a highly productive research group in STEM (Science, Technology, Engineering and Math) or Lab based fields requires all members of the lab or research group to effectively fill their respective roles, and to work together as a team. Each role has unique responsibilities, goals, mentorship needs and desired outcomes that differentiate it from other roles. For example, graduate students and research staff have different goals and responsibilities that require a different relationship with the Principal Investigator (PI) of the group; to research staff the PI is more of an employer, while to graduate students the PI is a mentor. While employer and mentor are not mutually exclusive roles, not fully appreciating their differences, such as considering the graduate student an employee rather than a mentee, may cause problems that result in the student not receiving the training necessary to be a successful graduate student and productive independent researcher, and may also reduce the overall productivity of the group. Here we discuss some tips, strategies and best practices that can help you, as a Graduate Supervisor, to be an effective mentor to graduate students in a way that will help contribute to having a highly productive research group.

1. Try to determine if prospective students will be a good fit for you and your lab, before agreeing to supervise them. Many of the problems that arise in the student/supervisor relationship can be avoided by only taking on students with whom you are most likely to be compatible.

   a) Be self-reflective and know your own mentoring style (e.g. more vs. less directive). Discuss with prospective students your mentoring style and determine if this style is compatible with their needs and how they would like to be mentored.

   b) Do not solely rely on the letters sent by referees. Contact referees (preferably not by e-mail, but rather by phone or Skype) and discuss with them the prospective student’s research potential, lab aptitude, interpersonal skills, etc. Before the conservation, prepare a list of questions that can help gain a clearer picture of the strengths and weaknesses of the prospective student. Referees will often be more willing to discuss potential weaknesses of a student in a one on one conversation than include them in a letter of reference.

   c) Meet the student before agreeing to mentor them. A face to face meeting is preferable because this allows you to have a back and forth discussion, and more fully probe potential areas of concern. If a face to face meeting is not possible, consider having one or more Skype interviews. During these interviews try to assess their level of interest in the work undertaken by your group. Are they familiar
with papers published by your group? Do they have ideas as to future directions, and the types of projects that they would like to pursue? Do they sound interested?

d) Start recruiting early. If you anticipate having room in your group for additional graduate students in the next year or two, begin to talk to potential students at conferences or other venues well in advance. You are more likely to recruit a student who is a good fit if you are not feeling pressed to recruit someone in a relatively short period of time.

e) Try to have a clear picture as to the type and level of mentorship that a particular prospective student will need. What level is their background knowledge in the research area? Do they have relevant technical skills? How is their English language proficiency—will this impact their ability to write a thesis? How are their writing skills? By assessing the student in these and other relevant areas, you will be able to determine if you have the time and the expertise needed to properly mentor the prospective student.

2. Provide thoughtful onboarding for new students. Providing students with the necessary information, training, and expectations helps ensure that they reach a high level of productivity quickly, and can help prevent conflicts and bad habits from developing.

a) Utilize the Checklist of Expectations for Graduate Student and Supervisor. This form should be completed in a meeting with you and the student soon after he/she begins their program and no later than two months after starting in program. This meeting allows you and the student to discuss your expectations of each other, and discuss ways in which your mentorship relationship can be most productive. Included in this meeting will be discussions on funding, attending conferences, deadlines, courses, authorship, grant/scholarship applications, etc.

b) Discuss with the student their research and career goals early in their training. Supervisors not only provide guidance and mentorship regarding their student’s research projects, but also help students develop skills and obtain training that will help them reach their future research and career goals. It is important to have a discussion early in the student’s program as to their career goals because this will influence the mentorship you will provide. For example, whether a student seeks to pursue a career in academia or industry may influence the networking opportunities that you can help them participate in. Provide them with realistic advice on career opportunities so that they are aware of the effort that may be required to reach their career goals. UCalgary has many resources that can assist students train for future careers and help supervisors educate their students, including many My GradSkills workshops, Transformative Talent Internships (paid internships to obtain industry experience), and the Versatile PhD (a database of non-academia occupations for PhD graduates).

c) Have students get into a publishing mindset early in their program. Discuss with them what their first publication could look like, including what you anticipate as a timeline. Help them to set goals in completing experiments and figure preparation. Also discuss with them how the plans and goals for a publication will need to be continually updated depending on the outcome of experiments and advances in the field. Discuss with them how to do reference management, choose a journal, identify authors, etc.
d) Help students remain busy during the first days and weeks. It often takes time for students to build their projects up to a level that keeps them fully engaged. Therefore, it is important to have meaningful activities in their initial time in the lab that will keep them engaged and productive. These activities could include receiving training on lab equipment, learning experimental techniques that they are likely to use for their project, reviewing literature related to their project, researching grant/scholarship opportunities, etc. Some supervisors encourage their students to come into the lab every day, even when experiments are not working, in order to prevent bad habits from developing. This helps them to get to know the team and assist others, which could help them learn new skills and provide opportunities for authorship.

e) Meet with your students often, especially early in their program, to ensure that they have the resources and expertise needed to make significant progress with their project. It also provides opportunity for them to express their concerns or ask for assistance.

3) Have productive lab and/or group meetings. Successful lab/group meetings can have many benefits, including; increasing the enthusiasm for research topics, identifying potential resolutions for experimental difficulties, providing opportunities for students to improve presentation skills, helping group members develop critical thinking skills as they discuss potential interpretations of data, provide opportunities for positive feedback and congratulations for accomplishments, building a more collaborative team environment, helping to establish productivity expectations, etc. There are many different models for lab/group meetings that can be successful. Try different models until you find one that works for your group and that meets your goals for the meeting. Below are some lab meeting models.

a) Single Presenter- Trainees take turns presenting their research, with one trainee presenting each week. Many supervisors have found it important to emphasize that students should not just discuss completed experiments with polished data, but rather also discuss experiments with which they are experiencing difficulties, or data that they are having trouble interpreting. This allows the group to provide input. Group members may need to be encouraged to provide input.

b) Round Table- Each meeting all group members discuss what they have been ‘up to’ since the previous meeting. Group members are encouraged to discuss any problems they may have encountered, and the rest of the lab can then offer suggestions to overcome difficulties.

c) Skill Training- Some lab/group meetings, or portion of these meetings, can be devoted to the training on specific skills. You or another expert may present on a new technique or equipment, how to use referencing software, new databases available, etc.

4) Help your group work together as a team. A high level of productivity is more likely to be achieved when members of the group work together collaboratively. By working in a collaborative team environment, graduate students will develop interpersonal skills, as well as gain a greater appreciation for establishing collaborations. Soon after they have joined the lab, discuss with your student the
various strengths and expertise of the different members of the lab, so that they know who to approach for help in specific areas. Also let them know that they will be expected to assist others as well, especially as they acquire expertise with techniques that others may not have.

Sometimes competition in the lab or group can become unhealthy, and result in a toxic work environment. If you notice disruptive personalities in your group, try to address the situation early, before harmful attitudes and practices become engrained. How to address these situations will be varied and situation specific. Team building exercises, such as lab hikes or other outings, can often help to strengthen the relationships between team members.

The student is not a technician and the supervisors need to be aware of this. Being a team member often involves helping with something other than their project. It can help the lab spirit and efficiency if different students help with specific tasks and training. Perhaps one may be in charge of a piece of software or equipment. There is a balance to be reached here though. It is unlikely to be appropriate to assign a student to undertake tasks that will require a lot of their time and are not directly involved with their thesis. This could slow the thesis and promote both burnout and resentment.

5) Assist students to be self-motivated. Students are less likely to be productive over the long-term if they are continually relying on their supervisor for motivation; therefore, it is best if students develop their own motivation and excitement for their research. Supervisors can help to establish an environment in which students are more likely to be self-motivated.

a) Help your students take ownership of their project by having them take an active role in defining the project and determining its direction. While there are parameters within which the research project must fit (determined by factors such as the objectives the grant that is providing funds for the project, the expertise of the supervisor, and the likelihood of success), students are often more motivated when they have a significant role in determining the purpose and direction of the project.

b) Communicate to your students that you consider their research to be exciting and worth pursuing. If your students sense that you are indifferent about their research, they may feed off of this and lose some of their enthusiasm for the project.

c) Provide your students with some structure that can help them experience success by reaching short and intermediate term goals. Students are more likely to maintain enthusiasm for their project if they sense that they are achieving milestones, making progress, and receiving positive reinforcement. Publishing a paper or completing their thesis can take a very long time to complete; therefore, they provide limited opportunity for positive reinforcement. To maintain a high level of enthusiasm, it can help to set short and intermediate term goals, such as completing a specific experiment, or finishing figures that can be part of a future manuscript. Upon achieving these goals, positive reinforcement could be delivered through congratulatory praise, acknowledgment in a lab meeting, offer to attend a conference, etc.
d) Be aware of burnout, and address promptly if observed. Some students may work at an intensity that they cannot sustain. Watch for students that experience a marked decrease in productivity or increased absenteeism, and determine if they could benefit from some intervention. Depending on what you have observed, intervention could involve encouraging the student to take some time away from the lab, having someone else in the lab assist them with certain experiments, accessing workshops or counseling through SU Health and Wellness, etc

6) Conflict avoidance and resolution. A productive research group is more likely to be achieved when members of the group respect one another and enjoy working together. Conflicts can arise between members of the group, or between you and group members, that if left unresolved could result in a toxic work environment. In a toxic work environment group members are less likely to collaborate or assist each other, and some may reduce their time in the lab, resulting in reduced productivity. Therefore, it is important to implement practices that reduce the probability of conflict arising, and that resolve existing conflicts.

a) Be loyal to your students. Never gossip about your students with colleagues or other students.

b) Be as transparent as possible regarding differing opportunities for your students. For example, if one student is chosen to attend and present at a conference, discuss with the other students why this student was chosen, and what opportunities other students may have in the future.

c) When encouraging students to work hard and be productive, emphasize how this is necessary for them to achieve their own research and career goals. If instead you tell them that they must work harder in order for you to reach your objectives (e.g. secure your grant funding, secure promotion or tenure, etc.), they are less likely to change their behaviour to improve productivity.

d) Encourage students to inform you when there are problems, and express appreciation when they do. Let them know that you will address the situation, and if appropriate, when progress has been made.

e) Access the various workshops and resources that are available on campus to resolve conflicts. These can be found in the Resolving Conflicts in the Graduate Student/Supervisor Relationship document.

7) Fully commit to a mentorship role

Faculty members have many different responsibilities and pressures on their time. The timing for many of these responsibilities is somewhat inflexible, such as when to deliver lectures or when grant applications are due. When to meet with graduate students and provide mentorship can be more flexible, which can sometimes result in students being neglected. This can result in students floundering, and a reduced level of productivity. Therefore, it is important to fully commit to your supervisory role, and be actively engaged in mentoring your students. Some ways to commit to this mentoring relationship include the following.
a) Recognize that you have made a long term commitment to your students. As a mentor, it is inappropriate to use terms such as ‘hire’ or ‘fire’ when referring to graduate students. Rather, you have committed to supervise your students, and they have committed to receive supervision from you. Only under exceptional circumstances can this relationship be severed (Guidelines for requesting change supervisor).

b) In most fields, the proportion of Graduate Students obtaining employment in academia has been decreasing, with most students obtaining employment outside of academia. Therefore, it is important for graduate students to obtain skills, training and experience that can be valuable in a wide range of occupations. As supervisors, we can sometimes focus almost exclusively on research productivity and publications, and neglect other training opportunities that can help students acquire other skills that could help them obtain employment and be successful in these careers.

c) Accept time commitment involved in supervision. Recognize that providing quality supervision does require a substantial amount of time; therefore, it is important to plan accordingly.