Providing Student Opportunities That Also Help You Succeed

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I. Introduction

As a new faculty member, it is important to get a solid start by making good choices. One important choice is the selection of graduate and undergraduate students to aid you in your research and the follow up publication of your research in peer reviewed journal papers. This paper will discuss some of the common characteristics and attitudes we have found useful in identifying student research assistants with potential.

The inclusion of undergraduate students in research projects will be discussed. Undergraduate research can be rewarding for both the advisor as well as the student. The mentoring needed for working with undergraduate students goes beyond that of an undergraduate academic advisor. In addition, the relationship between advisor and student may differ considerably when compared to the relationships with graduate students because most undergraduate students will choose not to pursue a graduate degree and therefore have different life goals. Not only will involving undergraduate students in your research benefit you, but the involvement will make the students undergraduate experience more meaningful.

Time management in mentoring undergraduate and graduate researchers will be woven into the overall discussions. This is an area that may cause burnout for new faculty if they don't pay attention to it. The transition from graduate student to new faculty is truly a challenging one. Finding students (like you used to be) is an essential step, and then mentoring them towards fulfillment for both you and them is a learning process. New faculty accustomed to doing it all themselves often have a hard time handing project ownership over to students.

During this talk, we will encourage an open discussion to provide feedback on specific issues that new faculty may have run into. While many of the points made in this paper seem like common sense, challenge yourself to see if you are following common sense on an everyday basis. It is easy to say the following ideas are obvious, what is not obvious is how to implement them on a day to day basis.

II. Characteristics of successful student researchers

We have identified some general characteristics that can be used to distinguish students with research potential. It is often easier to find students if you begin by selecting from students whom you know personally from class or who have been strongly recommended by other faculty, as opposed to choosing students based purely on their transcripts and school applications. Some of the best research students may not have the best grade point averages (GPAs). GPAs are often not indicative of the quality research work a student can do since these

averages usually reflect how well the student performs on tests. Often the GPA of a student will improve while they work in a research group.

A good indicator of success is the student's attitude towards work. If the students realize that it is a privilege to work in your lab, even when you are paying them, they will often excel. We recommend paying your students hourly or encouraging them to work on an independent study project for credit. Otherwise, it is too easy for other demands to get in the way of work. Without pay or credit the student may not recognize that this is a serious position being offered. You want to choose students who have a sense of responsibility, who will be motivated to work consistently for you, and who have the confidence to let you know when they are overwhelmed with classes and work and thus need more time. Look for students with internal motivation and the ability to get things done. Avoid students who always find excuses for not getting things done.

When choosing potential student researchers from the classes you teach, we suggest you look for those who are curious and exhibit a certain "spark". One way to identify these students is to assign open-ended projects in your courses. Typically, the good researchers will quickly push the project past basic requirements. Once you have identified potential students, initially approach them about joining your research group, but then leave it up to them to pursue this lead. Their follow through is a good indicator of their motivation and initiative. Good undergraduate candidates are often identified by their initial follow-ups.

III. Undergraduate research assistants

Undergraduate students can conduct good research. However, their skills are often underutilized and unrecognized by faculty. We strongly suggest that you consider including them in your research projects for a number of reasons:

1. Typically young students are very knowledgeable about computers. You can initially involve them in your research by letting them develop or maintain the research group's web page. Web page maintenance will expose the undergraduate students to your research as well as the other students in your research group. As a result, the student may decide to get more involved in a particular area of interest.
2. Undergraduates think very creatively and are not limited by the common knowledge or current theory (which they have not learned yet!). This "inability" to know the limits may help you develop a very progressive research program.
3. There may be many funding opportunities available on your campus to pay your undergraduate students. Therefore, you may not have to come up with external grant money to pay them, and yet they may enhance the outcome of you external grant research. In addition, if you have funding from NSF, you may apply for NSF undergraduate funding to supplement your program.
4. Work that graduate students typically view as repetitive and routine is often exciting for undergraduate students. By having the undergraduates help with this aspect of research, the overall productivity of the research lab will increase.

Not only can your research group benefit from the hiring of undergraduate students, but your undergraduate researchers will also learn a lot from this experience. First, by involving undergraduate students in your research, they will be given the opportunity to learn firsthand what research is and as a result may gain a better appreciation for their coursework. They will also be given a valuable opportunity to interact with graduate students, beyond those they encounter as teaching assistants, and to learn about graduate school. Should they choose to pursue a graduate degree, their research experience will make them better candidates for fellowships. If they decide to continue their education at your institution, they may choose to continue to work with you, thus becoming a graduate student who can immediately make valuable contributions to your research.

Should the student choose not to pursue a graduate degree, they can include the research experience on their resumes. Your students can distinguish themselves from other applicants by showing potential employers that they had important responsibilities and were active productive participants in the research group. In addition, with enough support and preparation, undergraduate researchers can also give fantastic presentations at conferences. The experience is excellent for them whether they choose to pursue research or go into industry. The papers presented at conferences often lead to peer reviewed journal papers. The student gains more confidence and this will reflect in their interviews with graduate schools and potential employers. If the students do go into industry, they will prove valuable assets in establishing research and student-employment opportunities with industry.

Many people believe that a lot of extra work is necessary to prepare research for undergraduates, we have not found this to be true. Simply putting undergraduate students into the research environment allows them to excel without specific adaptations due to their "limited" background. Each student has a rich background of experiences, with individual help they find the resources they need to learn more about the research, not really any different than a graduate student, although perhaps at a different level. Undergraduates who need calculus will learn calculus – it is a great way to motivate coursework. It also teaches students they can teach themselves and that they should view instructors as coaches to guide them thorough the material. This is a very empowering thing to realize as an undergraduate.

IV. Mentoring undergraduate and graduate researchers

Once you have your research group organized, you need to mentor your students. This commitment can be gratifying and rewarding, as well as frustrating and time-consuming. Here are some suggestions as to how to make your relationship with your students succeed:

1. Watch their schoolwork carefully. You should periodically ask your students how their classes are going and encouraging them to discuss any problems with their instructor. You also need to make sure they know their coursework is more important than the research and that their exams should be a priority. If they can tell you in advance when they have tests or important assignments due, you will be prepared to not count on them as much that week.
2. Don't solve the problem for them. Let them explore their own ideas. By creating a program where the students cannot think independently, you may wind up investing too much time

into the student with minimal return. You need to challenge your students to work. Those students who are not ready for this responsibility will wander out of the program.

3. Encourage students to support each other and get involved in each other's projects. Remember how quickly you tend to find solutions to problems when you have to explain the problems to someone else? You can offload some of your time mentoring by encouraging your students to work together. Not only will they learn from each other, they will also not need to come to you with every problem.
4. Ask for solutions, not problems. Make sure that your students know that the "I tried what we talked about but it didn't work" attitude is not acceptable. By letting them know that you expect an "I tried what you talked about, it didn't work, and so I tried this, with an interesting result, what do you think" attitude from the start, you will be encouraging independent thinking immediately. While this may cost you some time at the beginning, in the long run, once they get it, your students will be more productive researchers.
5. If you have a small research group, look for other students in a similar program or another research group and find ways to link your students up for support. Consider introducing your students to others through a pizza party. This is a small investment for a potentially big pay off in terms of your mentoring time.
6. Make sure your students know you respect that they have lives outside of school. Ask how things are going occasionally, with details like "How is your team doing in the softball series?". It is important for them to know that you know they do other things than research. However, make sure they also realize that school is their job and that you expect them to take it seriously.
7. If you cannot hire your student researchers full-time during the summer, play an active role in finding them a summer internship. If they can work for a company doing work similar to that in your research group, this will increase the likelihood that they will return to your research group at the beginning of the school year. It will also help them to understand how your research is relevant to the "real" world. Take the opportunity to visit them if possible, especially if they will give a presentation. This is a great opportunity to begin setting up a potential research program with the company.
8. Make sure your students understand the goals of your research program. As a young faculty member, papers are critical to your success. Make sure your students understand that you expect them to be doing background research, reading up on the topics they are working on. You expect that they will begin outlining potential papers and discussing with you what needs to get done to complete the study. Wrapping papers around research early in the process may sound premature but it does help to organize you and the student, and helps to clarify that you have common goals. This process is very beneficial to inexperienced research students, who usually feel lost with very open ended projects. It gives them a mechanism to look at what types of results they might think about getting. Usually going through this process is very motivating to the student, they realize research they are performing might be worthy of publication in a peer reviewed journal.

In addition to the above suggestions, we also would make other recommendations specifically when mentoring undergraduate researchers. You should hire at least two undergraduates so they can work together. Not only are two heads better than one, but they will feel less isolated in the research group. If possible, get your undergraduates desk space in your lab. They can share desks if space is a problem. Your undergraduate researchers will perform better if they feel that

they physically belong in your research group. Involving them in your group meetings and getting to know them personally are indicators that you value their contributions. In addition you should encourage them to talk to other professors about their work and to get involved in student organizations (provided they can handle the time commitment). If you have an undergraduate student who does not feel that they have the time commitment to work for you a particular semester, you can encourage them to at least attend your group research meetings. This will help to keep the interest of the student engaged. Finally, have your graduate students help you with the mentoring of your undergraduate researchers. They may feel more comfortable discussing certain topics with other students instead of with their advisor or other professors.

V. Bottom Line

New faculty are often pressured to find reliable graduate students to help their research program grow and publish right away. In this paper, we presented some of the common characteristics we have identified in successful student researchers. We also discussed why you might want to consider mentoring undergraduate research students as an early and continuing part of your program. Including undergraduate students in your research can be rewarding by strengthening your research and industrial ties when they graduate. If your undergraduate student chooses to pursue a graduate degree at another institution, you can recommend them to your colleagues, who will be happy that you sent them a solid graduate student. Consequently, they may return the favor by sending you a solid graduate student or by setting up collaborative projects between your research programs. For your student researchers who decide on industrial positions after graduation, they may eventually provide internships for younger students or may be able to initiate industrial contacts and connections for you that you otherwise would have not made. In addition, the companies who have good experiences with a few of your students will contact you to fill other positions and to potentially develop formal cooperative programs with your research group. As a result of these affiliations, government funding agencies will regard your research as industrially relevant. Meanwhile, the students can also really help get the papers published, which is essential to your success as a faculty member.

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