

Seven Steps to Success in Graduate School (and Beyond)

Adapted from [N. J. Halas](#)

The following is a list of essential skills that all successful researchers have developed. Without these skills, you cannot expect to succeed in research. If you fully develop your abilities in each of these areas, you will lay a strong foundation for the rest of your research career that will lead directly to success in research. The responsibility for the development of these skills is entirely your own. Your research advisor can provide guidance and assistance, but your graduate education is your personal responsibility.

This list is meant to serve as a personal barometer for you to analyze your strong and weak areas.

- **WORK**

Develop a sense of urgency and the habit of working hard at solving problems. Execute a project, master the difficulties, debug your theory.

- **THINK**

Understand, explain, and interpret your results. Learn how to perform numerical experiments to gain insight and help construct theories. Continually ask how far you can push and extend your idea. Be contrarian: do not blindly accept claims and conclusions, but rather question whether they are really true and whether they can be extended or applied in new contexts.

- **READ**

Investigate your area. Learn its history and context, understand its technical foundation and background. Learn to read technical papers with a critical eye, and with the expectation of being able to duplicate and extend what is described in the article. Follow your field by reading current journals. Know who did what in your field as well as related areas.

Learn about other areas. Broaden yourself by reading articles in *IEEE Spectrum*, *IEEE Signal Processing Magazine*, *Science*, *Scientific American*, and other journals and magazines. Become familiar with other theoretical fields and

application areas.

- **WRITE**

Write concise and focussed technical papers. Write a larger and more comprehensive document (thesis). Learn how to write proposals. Learn word processing and text formatting appropriate for scientific documents.

- **SPEAK**

Discuss your ongoing research with peers, colleagues, and visitors in an informal setting and at conferences. Learn how to make a well-organized, coherent, and engaging presentation of your research results in front of an audience. Understand the differences in speaking to a general audience versus a technical audience. Cultivate professional contacts and associations.

- **MANAGE**

Time: Develop a sense of how long any specific task will take you to execute.

People: Develop succesful working relationships with the people you work with.

Research: Develop a research *program*, not just a number of disconnected projects.

- **CONTEMPLATE**

Anticipate where research is going in your area, both your own and of your colleagues'. Become a generator of research ideas. Learn to be able to judge when an idea is feasible and when a research direction is important or impacting. Keep track of ideas, perhaps in a research diary. Search for connections between ideas.



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