

10 Skills and Competencies for Science Majors

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National attention has focused on increasing the number of graduates in STEM (science, technology, engineering, and mathematics) graduates from our colleges and universities. Every effort must be made to insure that students are prepared for the scientific workplace. However, science graduates, unlike their counterparts in engineering and computer science, do not have an external accreditation organization that prescribes skill and competency requirements for graduation. However, scientific societies, such as ACS and AAAS, have identified concepts and competencies that science graduates should demonstrate as they enter the workforce.

Science education places its focus on learning and gaining mastery of the discipline of study and basic laboratory techniques. Less attention has traditionally been given to broader workplace skills, such as communication, teamwork, and contextual practice. This situation is changing as evidenced by the recent report from AAAS entitled *Vision and Change* where science educators were charged with embedding some of these skills into the curriculum.

In an attempt to learn how well science graduates are transitioning into the workplace and establishing their careers, we asked only those employers in our national recruiting study who anticipated hiring physical and biological science majors what key competencies they believe scientists should possess. Respondents are typically human resource professionals but the sample does include some laboratory managers and production line supervisors. The results presented in this short note are a first step in obtaining a general understanding of science-based skills and competencies needed in the workplace. The next step would be to address similar questions to laboratory or field supervisors.

“Most faculty agree that to be scientifically literate students need to understand a few overarching concepts: Evolution; Pathways and Transformations of energy and matter; Information flow, exchange, and storage; Structure and function; Systems. As important, undergraduates need to understand the process of science, the interdisciplinary nature of the new biology, and how science is closely integrated within society. Students also should be competent in communication and collaboration, as well as have a certain level of quantitative competency, and a basic ability to understand and interpret data.: Vision and Change

A total of 257 respondents who expect to hire physical and biological science majors (excluded K-12 schools who were looking for elementary, middle school, and high school teachers) provided feedback to this open-ended question:

“What are the key skills and competencies that physical and biological science majors have to demonstrate to obtain employment in your organization?”

Their comments were sorted into common categories and tabulated. We arrived at **10 Skills and Competencies** that appeared to be important for success in a scientific-focused work environment. The following skills are ordered based on the frequency they were mentioned.

- **Balance of technical knowledge with interpersonal skills**, including the ability to communicate technical information to non-technical people. (29%)
 - “Ability to communicate effectively and work collaboratively in a team.”
 - “Develop good working relationships with customers and staff.”
- **Command of the basics**: write, communicate, summarize, and report, including the ability to maintain confidential material. (18%)
 - “Ability to collect, record, and report data accurately.”
 - “Ability to gather and process data, draw appropriate conclusions, and communicate those conclusions in a cogent presentation.”
 - “Sadly, an area that is greatly lacking has become verbal and written communication skills. We have encountered Ivy League graduates with awful grammar and spelling errors on their resumes. We pay people to deal with the highest levels of the Armed Forces, the DOD and other Federal agencies. When they can’t even write a proper sentence or address a letter to one of these women or men, it is embarrassing and hurtful to our business.”
- **Genuine mastery of their discipline** of study, allowing them to contribute educated opinions. (16%)
 - “High level of achievement in their field and a strong quantitative background.”
 - “Often students are trained to regurgitate information they’ve read elsewhere, but the highly qualified students are those that can analyze, digest and produce original insight.”
- **Experience**: have professional training which can include internships, cooperative education, undergraduate research projects, and summer work engagements in professional settings before entering the workplace. (15%)
 - “Appropriate training, credentials.”
 - “Experience with multiple lab tests and types of equipment, following protocols, test methods, procedures.”
- **Ability to adapt knowledge to different contexts**. (14%)
 - “Practical application of their academic knowledge.”
- **Diverse skills in problem solving and scientific method** with a strong analytical mind. (14%)
 - “Ability to think on feet, problem solve.”
 - “We need the new hire to have critical thinking skills, be able to apply research findings, write clearly, be a flexible problem solver.”
 - “Highly analytical thinking with demonstrated talent for identifying, scrutinizing, improving, and streamlining complex work processes.”
- **Ability to adapt** to the professional business environment. (12%)

- “Ability to hit the ground running.”
- “Understand the regulations and their application to different businesses.”
- “They need to be able to see the big picture. They need to be able to multi-task, deal with conflict, be organized and project orientated.”
- Having skills in several **diverse science backgrounds**. (11%)
- A strong **knowledge of technology**, including the ability to use various computer programs. (11%)
- **Clinical and laboratory skills**, as well as an ability to conduct field work. (7%)
 - “Good thesis work, including familiarity with laboratory procedures, equipment, and protocols.”