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## Workshop Synthesis

The final session of the workshop asked participants to summarize their closing thoughts about the workshop topics and experiences. The list below represents a synthesis of some of the common themes about integrating engineering, sustainability, and the geosciences.

See [workshop outcomes](#) that build from the ideas expressed in this synthesis.

- Employment in energy, environmental and extractive areas for geoscientists with core geology, quantitative and communication skills will be robust over the next decade as demand for resources grow and the current workforce retires. Carbon sequestration may provide another focus of very large demand for geoscientists with traditional skills. Employment in sustainability related fields is also expected to grow. We may face the need for rapid growth in enrollments to meet workforce demand.
- There appear to be strong needs for a technical workforce with 2 Year or 4 year degrees as well as a variety of options for other types of employment. This includes jobs in hydrotech, GIS, forecasting and undefined jobs related to the extraction industry. We know less about these jobs. The SAGE project is exploring [opportunities for students with 2 year degrees](#). We would value more information about employment at different degree levels, both the history of employment, the nature of jobs, and the potential in the future.
- Employers are seeking the combination of strong technical, quantitative, communication, time management and critical thinking skills. The specific technical skills are highly specific to the employer and employment needs. Thus there is not a single answer to the question 'What skills make a student employable?'. Employers at this workshop emphasized the value of data analysis, quantitative, and problem solving skills over broad awareness of policy issues. Employers value the ability to articulate an appropriate, effective, creative next step. Employers are also very interested in enthusiasm and drive.
- The challenge faced by geoscience programs is developing pathways into the workforce for the variety of students in their programs who bring different skills and interests to their studies. Workforce data suggest that in the past only 30% of undergraduate students have remained in the geosciences suggesting that departments are playing an important role in developing the workforce beyond the geosciences. Programs at the workshop have a range of experience from 90% placement in geoscience to students pursuing a wide range of opportunities. The collection of [program descriptions](#) describes what is known about career pathways from programs participating in the workshop.
- Geoscience programs develop valuable [skills that are transferable to work beyond the geosciences](#) including systems thinking, data analysis, temporal and spatial reasoning, working with incomplete and/or noisy data sets, and integrating historical contingency with reductionist science. Students and faculty may not be aware of the value of these skills in the workforce.
- Programs either have in place or recognize the value of building strong linkages to local or regional employers. This can provide needed info for students on career pathways, build interest in the program, provide opportunities for internships, provide financial resources for programming of mutual interest, and yield other benefits. Alumni play a critical role in these activities. The workshop participants developed these recommendations for [connecting with employers in systematic ways](#).
- There are fewer models for building linkages to national or international employment opportunities (though these clearly exist between the oil industry and specific target schools). Professional associations play an important role both as a clearing house for these opportunities and as networking centers.
- As higher education goes through a transformation related to changing educational needs and to cost containment, new models for education are emerging. One model focuses on assessing competencies rather than on instructional structure to document workforce readiness. This model requires a strong understanding and articulation of the competencies that constitute mastery of the degree. Similarly, accreditation increasingly requires measurement of student achievement of program learning outcomes.
- Participants felt that the learning outcomes that their programs have in place were in line with the needs expressed by employers. Professional skills were an area of focus for strengthening outcomes. In some cases the geoscientific thinking skills are not explicit in the outcomes. Making these more explicit highlights transferable skills to both students and employers.
- Preparing students for the workforce requires attention to professional skills, as well as to the skills needed to identify career pathways and land a job. This critical work takes place both inside and outside of course work and occurs as [a progression throughout the course of study](#). Models for supporting the [students professional development](#) range from educating faculty to be strong career advisors to employing a career advisor in the department, to working with the career center, to outsourcing this work.
- Students, particularly graduate students depend heavily on faculty for advice about careers and jobs. Faculty are typically not well informed about the breadth of career options and the preparation needed for this range of jobs. More work is needed to educate faculty in this area or to provide alternate modes of informing students.
- Communication skills play a pivotal role in obtaining a job and succeeding in the workforce. These skills include the ability to customize information for an audience, to present information at appropriate levels, to effectively communicate in oral, written and visual forms, and to scale the information to the time and format that is requested or appropriate.
- Geoscience is still struggling to both attract a diverse group of students and to move them into the workforce. High school recruiting models, academic and personal support for interested students, and cultivation of role models are beginning to show success. Workshop participants discussed a variety of strategies for [strengthening engagement of diverse students in the discipline](#).
- Real world experience, through internships, service learning, co-ops or other mechanisms is critical to workforce preparation, to identifying a desirable career path, and to workforce success. There are now [many models](#) for these types of programs. In many cases students make these types of opportunities for themselves. We are still in the midst of a transition to fully incorporating this type of learning into our programs. Scaling up, managing and evaluating student learning in these experiences is a challenge. This is an opportunity for partnerships between employers and educators. Workshop participants developed some guidance for programs [establishing co-op or internship programs](#).
- Given the diversity of employment opportunities, their regional variation, and the strengths of different departments and their students. We should not expect a one size fits all approach but rather programs that capitalize on the specific location, students and strengths.



Some employers could offer plenty of money, but were in an undesirable location. 