

**R**esponding to  
**A**dministrative  
**P**riorities**Language Skills and Conceptual Understanding**

*Capsule:* Learning multiple languages provides students with another means to interpret information. Being multilingual has been linked with increased problem solving abilities and creativity.

*Summary:*

Diamond (2010) reported on research that indicated that multilingual children have an advantage over monolingual students in control of executive function system. The executive function system is a mechanism by which individuals filter competing stimuli experienced through the senses. For example, in a research conducted by Bialystok et al. (2009) bilingual 8 year-old children were compared to monolingual children to determine if the bilingual children showed a difference in the use executive function control. The results of the study indicate that multilingual children were better able to cope with rule changes, which is indication of enhanced executive function control. This ability could be linked with the ability to be a better problem solver, which is a key characteristic to have as a science or an engineer. Other potential benefits of being multilingual include increased creativity and flexibility. Knowing different languages provides students with different pathways of thinking that are especially important to consider when teaching or evaluating students.

Additionally, because of the benefits of being multilingual, Porter (2010) argues that students should learn more than one language on the basis that it can help them to be culturally sensitive citizens that are able to function in a global society. Parkinson (2009) presents reasons why global competence is an important attribute for future engineers. Global competence, as presented by Parkinson from other sources, “emphasizes skills such as cultural empathy, foreign language ability, or the ability to practice one’s profession in an international setting” (pg. 9). While attaining global competence should be a high priority for engineers, Blumenthal and Grothus (2008) conclude that despite the need for American engineers to gain “multicultural” skills, “there is less of a tradition in this field to acquire such skills through study abroad than in many other fields (pg. 11).

Language provides a means of communication between the learner and the conceptual material that must be learned. An illustration of the need to understand the language of study is provided by a student conducted by Holvikivi (2007) in which he investigated the reasoning ability of international engineering students and professors. The study results indicated that the language used in the study may have influenced how the participants responded to the questions of formal reasoning. The author concluded that “people may apply different types of thinking when using their native language and when using a second language.” This study highlights the importance of being aware of the implications that language has on students’ understanding of conceptual material.

## Responding to Administrative Priorities

*Implications in Engineering Education:* What distinguishes many academic disciplines from each other is the language used within the discipline. Further, a major part of the enculturation of a student to a specific discipline involves the student becoming knowledgeable of how to speak the language of the discipline. Learning the language of a particular discipline can be an especially difficult process because the language becomes even more specialized when it comes to unique areas of a discipline. For example, an engineer's understanding of the word "heat" differs from the general public. The importance of language to engineering education suggests that students should be provided with opportunities to communicate written and orally. It suggests that a greater link should be made to the students' abilities to effectively understand and communicate science.

It also suggests that learning a foreign language would be beneficial for engineering students. As reported by Diamond (2010) and Porter (2010), Americans rarely learn to become fluent in more than one language. The fact that students often have difficulty acquiring the language of engineering and science because of its dissimilarity to everyday language is not surprising, given that they rarely have the opportunity to practice acquiring another language. Therefore, learning a foreign language could potential offer students an opportunity to practice language acquisition skills..

- References:** Bialystok, E., & Viswanathan, M. (2009). Components of executive control with advantages fo bilingual children in two cultures. *Cognition*, 112, 494-500.
- Blumenthal, P., & Grothus, U. (2008). Developing Global Competence in Engineering Students: U.S. and German Approaches. *Online Journal for Global Engineering Education*, 3(2), 1-13.
- Diamond, J. (2010). The Benefits of Multilingualism. *Science* 330(6002), 332-333.
- Holvikivi, J. (2007). Logical Reasoning Ability in Engineering Students: A Case Study *IEEE Transactions on Education* 50(4), 367-372.
- Mammino, L. (2010). The Essential Role of Language Mastering in Science and Technology Education. *International Journal of Education and Information Technologies*, 4(3), 139-148.
- Parkinson, A. (2009). The Rationale for Developing Global Competence. *Online Journal for Global Engineering Education*, 4(2), 1-15.
- Porter, C. (2010). English Is Not Enough. *The Chronicle of Higher Education*.

**Prepared by:** Kellie Green, 2011 Christine Mirzayan Science & Technology Policy Fellow, April 6, 2011