Global Science and Education in the 21st Century

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Science and education are worldwide enterprises, and all highly developed countries invest heavily in science and education. Korea is expanding its research and education initiatives through government and private sector funding. Korea seeks to develop strong research as a means to grow its economy, enhance public good and to develop world-class universities that will be outstanding centers of research and learning. I joined the Department of Biological Sciences at KAIST in 2009 as part of the Graduate School of Nanoscience and Technology, World Class University(WCU) Program. I would like to explore three areas that are universal in science and education that I believe, I will have impact for the development of world class universities in the 21st century in Korea, namely, (1) the importance of English in the university curriculum, (2) recruitment of foreign faculty and students, and (3) the curriculum in science education.

English has become the international language of science and education, as well as in business and international relations. English permeates all facets of scholarly endeavors including textbooks, scientific journals, and conferences. Without a common language, Scholars in any country cannot communicate with their colleagues around the world. Almost all scientific books and journals are published in English, so it is critical that Korean scholars are adept at writing and reading English. Furthermore, international conferences are held in English so having the ability to orally communicate(both speaking and listening) is essential.

Given the importance of English as a second language, how do we best prepare Korean students to become proficient in English? At the university and college level there is much debate about whether or how to integrate English into the curriculum. Some schools have adopted an English-only policy for formal lectures. This presents some formidable problems for both faculty and students. Not all Korean professors are adequately prepared or comfortable to present their lectures in English. This can adversely affect the quality of a lecture and ability to teach. Furthermore, not all students entering university are ready to listen and absorb material presented in English lectures. This is an unfortunate outcome for both students and professors. How to overcome this obstacle to using English in the classroom is not easy. In some cases, Korean professors will use both English and Korean to clarify their lectures. Ideally a happy medium can be found where Korean students can

be exposed to university-level lectures and written assignments that facilitate strong English skills, without compromising their learning a given subject. Finally, Korean universities are increasing their recruitment of foreign students and in general foreign students expect lectures to be presented in English. Therefore the use of English in the classroom will need to become commonplace.

Do universities need foreign scholars and students? Great universities are melting pots comprised of faculty and students from different countries. A university benefits from foreign faculty and students because of the different academic expertise and cultural perspectives they will bring to a university campus. In addition, as discussed above, English has become the international language of science, and most foreign faculty will use English. The limitation of English-only lectures by foreign faculty should help facilitate the development of English skills of Korean university students.

Can Korean universities be attractive to foreign scholars and students? Korean universities have excellent infrastructure, faculty and students for scientific research and therefore the environment for conducting research is as good as anywhere in the world. However, even in the best-case scenario Korean universities might not be attractive to faculty and students for a number of reasons. The first and foremost is language. Most foreign faculty will come to Korea unable to communicate in Korean. Support to help adapting to life in Korea will have to be provided by the institutions to which they are recruited. The assignment of a Korean faculty member to mentor a foreign faculty in academic policies and granting agencies is one useful solution. Full professors or recently retired Korean faculty would be excellent mentors. Likewise, most foreign students will encounter a similar language barrier, as well as cultural challenges. Korean students could be assigned to act as student-mentors in helping the foreign students adjusting to life at their respective university.

Special programs have been developed to recruit foreign professors. The WCU program initiated in 2009 was designed, in part, to recruit foreign scholars, including Korean expats. It is still too early to determine if the program was successful in the permanent recruitment of true foreigners that decided to remain in Korea. In my case I selected to resign my tenured professorship at my previous university in America. In America tenure is a life-long contract as there is no age restriction on how long you remain at a university. Agreeing to position at a Korean university with a mandatory retirement at 65 was not an easy decision, but one I do not regret.

A critical issue for scientists is funding. Navigating the Korean system of grants is no easy task for foreign scientists, especially when most of the information available and application forms are in Korean. While controversial, it might be useful to establish a separate category of grants for foreign professors. This might help in recruiting and maintaining foreign faculty. A foreign faculty would be required to be the principle investigator of an individual research grant or of a joint research project involving the foreign scientist and Korean scientists. In the latter case, the foreign faculty would organize and recruit their research team. Importantly, the grant proposals should maintain high scientific standards and be subject to peer review. Such a funding mechanism would help in maintaining foreign scholars, who would also help in recruiting additional foreign scholars with their experience in navigating life, science and academia in Korea.

Finally, how do we prepare our students for careers in science in the 21st century? The curriculum for students in the 21st century needs to be altered from what was established and used in the 20th century. We need to teach students how to obtain information on their own and then apply knowledge to various problems they will encounter in their daily lives and as a professional. The use of original scientific literature, highlighting the reasoning and logic behind scientific discoveries is important. Students need to understand the limitations

of specific experiments and the results obtained. Therefore to better prepare our students it is important to incorporate critical thinking and complex problem solving into the curriculum. The discoveries of tomorrow will not be found in the textbooks of today.

In Korea, there is much discussion about convergent technologies, but universities are divided into departments. Students, as well as professors, are often sequestered into a specific discipline, their so-called major and department. Unfortunately this can limit the exposure and training a student needs to confront real-world problems, as well as the interaction faculty could have with colleagues in other departments. Courses need to be developed that show the relevance to a particular area. For example, biology major may be required to take calculus, physics, and chemistry, but the relationship and application of these subjects to understanding biological principles is not presented. Although these subjects are of fundamental importance, students are often left wondering the relevance of these courses to their future studies.

Interdisciplinary convergence is important in research and development and how we best foster innovation and creativity in the university is an important question for preparing our students for careers in science in the 21st century. Like convergent technologies, the same principles can be applied in education, so-called convergent education. Instead of a student simply enrolling in the list of required courses, they could design their curriculum around their interests and research needs.

Great institutions and its members are often at the forefront of change. Science is generally divided into basic and applied research. Basic research seeks to understand the world around us and applied research seeks to develop technologies that make the world a better place. Thus, it is important to complement a science education with a perspective from the humanities. The most wonderful part of teaching at a Korean university is the students. They are truly exceptional. Their dedication and commitment to their studies and learning is exemplary, and their respect and caring for their professors is something I find amazing. We owe it to them and future generations of students an education that is truly made for the 21st century. ***sema***

The application of science and technology in modernization and standardization of traditional Korean medicine

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Recently, the interest and use of complementary and alternative medicine (CAM) have been rapidly increased worldwide. It has been estimated that 38 percent of adults in the US have ever used some forms of CAM and this market worth a billion dollars. In many Asian countries, traditional medicine, a