ALBERTO G. CANEN, ANA CANEN, REJANE P. COSTA

HIGHER EDUCATION AND THE PREPARATION OF MULTICULTURAL GLOBAL CITIZENS: THE CASE OF A TECHNOLOGICAL CURRICULUM

Abstract

The present paper discusses the relevance of multicultural educational research that goes beyond human sciences so as to embed technological curriculum and the preparation of professionals of areas such as engineering as competent global citizens. It argues that multiculturally preparing engineers should be part of an educational project that places Higher Education Institutions (HEIs) at the forefront of innovation and the valuing of the preparation of a new generation of professionals more attuned to a globalized perspective that also incorporates a humanitarian, multiculturally oriented perspective. The paper discusses theoretical issues involved in a multicultural engineering curriculum, and then it focuses on educational research relative both to contemporary trends in the delivery of syllabuses in three engineering HEIs. It discusses challenges and possibilities in the translation of the idea of engineering for a global and multicultural perspective of competence into curriculum thinking and practice, suggesting ways ahead in order to boost it.

Key words: multiculturalism, global citizens, higher education, curriculum

Introduction

In the contemporary world, more and more education's role in preparing globally competent citizens have been recognized in higher education agendas around the world. However, critical educational researchers still struggle with the need to create innovation that not only helps advance technological perspectives, but should also value cultural diversity, and promote inclusion of marginalized identities in an increasingly unstable and plural world. Even though education and human sciences arenas have been increasingly exposed to such an outlook, the relevance of viewing technological areas in higher education as sites for educational research aimed at probing into possibilities for educating for the preparation of globally competent citizens that are committed not only to progress but also to the challenge of prejudices and to social inclusion cannot be stressed enough.

To analyze the extent to which engineering courses prepare their students towards cultural diversity and competence in a globalized perspective, there should be a discussion of the possible dialogues between hard and social sciences in order to promote more equitable relations, so that global competence should include the competence to deal with diversity and value plural identities on the lines of race, gender, social class and other identity markers. In this direction, there are authors who highlight the importance of technological areas towards those values in the following words:

> "What if everyone had fair and equitable access to the Earth's resources, a decent quality of life, and celebrated cultural diversity? Imagine future scientists, engineers, and business people designing technology and

> economic activities that sustain rather than degrade the natural environment and enhance human health and well-being?" (Cortese, 2003, p. 15).

Such questions lead to the relevance of interdisciplinary collaboration so as to boost cooperative efforts towards valuing cultural diversity in an increasingly globalized and multicultural world.

Based on that, the objective of the present paper is to analyze the extent to which education research could potentially help take engineering curriculum syllabuses into a more multiculturally driven perspective, in order to prepare future global citizens that value cultural diversity, inclusion and social sustainability. The paper builds on a theoretical framework that discusses issues involved in a multicultural perspective, linking those to the building of a specific framework towards an engineering for a multicultural curriculum. It then focuses on educational research carried out by the authors that has been developed relative both to contemporary trends in the engineering curriculum plan in two civilian Brazilian HEIs (Canen & Canen, 2011) and in a military one. The methodology is qualitative, based on a documentary analysis of the engineering curriculum plans of the mentioned three HEIs in Brazil, as well as on semi-structured interviews carried out with their coordinators.

The paper discusses challenges and possibilities in the translation of the idea of multicultural engineering into curriculum thinking and practice, suggesting ways ahead in order to boost it. It is expected it can contribute to a research agenda that tries to go beyond human sciences in higher education, so as to open up ways ahead in order to develop educational research geared towards preparing engineers and other technological professionals for a global perspective that is multiculturally oriented in nature.

A Multicultural Curriculum for Engineering: towards a possible framework for global competence

Education research could arguably potentially help take engineering curriculum syllabuses into a more multiculturally driven perspective. As claimed by Carter (2012), such a perspective includes lessons about conflict sources, transformation and resolution. It is based on standards that include the development of knowledge, skills and dispositions related to contextual awareness and multiculturalism, chiefly stressing the recognition of values, history and needs of people in communities and of those who have different cultural norms and histories. In that sense, as claimed by Bickmore (2011), conflict resolution perspectives can be infused in any academic curriculum, inasmuch as contrasting ideologies, perspectives, and problems are embedded in any subject matter, and may be brought into light, probed and discussed in classroom pedagogy. Ogunleye (2011) makes the point that social inclusion has become wedded to the European social policy agenda, highlighting the need to promote social inclusion of people from the disadvantaged groups, as well as the role of HEIs in helping to achieve that goal.

Bringing those arguments into the technological and engineering area, Canen & Canen (1999) talk about the need for logistics, which is a central subject in Production Engineering, to go "hand in hand" with multicultural concerns. Also, Costa (2012) highlights that human terrain and its sociocultural dimensions should

be deeply considered in military educational arena, so as to provide the development and better use of technical and technological means and their influence on the military doctrine.

In that sense, syllabuses in technological areas such as engineering could enhance the understanding of the meaning of multicultural organizations (Canen & Canen, 2005). In the same vein, Rahim *et al*. (2006) talk about an organizational climate in which empathy should be a central quality, so as to challenge any attempt to downcast those who think differently, therefore contributing to linking technological preparation to a multicultural perspective. Canen & Canen (2011) suggest a multicultural framework for education in technological syllabuses in Engineering courses and others. The mentioned framework includes components, such as: discussions of what it means to think multiculturally; devising practical strategies so as to develop multicultural competencies; analyzing topics of technological education in terms of understanding the role of cultural variables in problems, modeling and solutions, articulated to multicultural scenarios; developing the competency of applying research methodologies for cultural inquiry; and training in evaluating and assessing techniques that interrogate the extent of cultural sensitivity in everyday teaching practices. Such a framework could arguably promote the knowledge of cultural diversity, and help infuse a global perspective to the Engineering curriculum, inasmuch as such a process is proactive in the sense of nurturing social relationships that respect cultural diversity (Bickmore, 2011) and therefore are multiculturally oriented.

It should be noted that such a framework has been elaborated in a Brazilian specific context but it is intended to inspire technological curriculum elsewhere. In Brazil, an experience in International Logistics in the program of Production Engineering has successfully followed the mentioned framework, students becoming more aware of the interlinkages between technological preparation and multicultural and inclusion concerns.

Educational Research for Multicultural and Globally Competent Engineers Preparation: the role of HEIs

Educational research developed by the authors has been geared towards rethinking the role of HEIs in order to prepare professionals in the various areas, including engineering, to be competent global citizens attuned to the need to act in a multicultural, inclusionary way. The study to be described next referred to the extent to which syllabuses of an engineering curriculum in two civilian HEIs (Canen & Canen, 2011) and a military one (all of them were kept anonymous for the research ethical reasons) were sensitive to a globalized multicultural perspective in Brazil.

A documentary analysis of the program of Engineering in the military showed that syllabuses were generally presented in sentences that highlighted technological topics, devoid of discussions concerning multicultural issues. In fact, the core of the basic contents for the engineering course emphasized competencies such as:

> Know the foundations of mathematics, physics, chemistry and computer science that are needed to the diverse engineering specialties; know the scientific writing norms used in the report elaboration, technical works, projects, thesis; apply the theoretical knowledge acquired to practical

> problem resolution; communicate efficiently in written, oral and graphic languages; develop abilities and strategies to approach written texts in English language; fulfill and interpret results of practical experiments. (from the curriculum plan of the Engineering course, 2013).

As can be noted, cultural diversity has neither been mentioned nor registered in the mentioned course curricular guidelines, as opposed to what authors such as Bickmore (2011), Carter (2012), and Canen & Canen (2011) suggest. The relevance of talking of cultural diversity in the military technological courses cannot be stressed enough, inasmuch as military personnel should work in culturally disparate environments, and should be prepared to respect and understand those views, in a multicultural, peace oriented perspective. Cultural diversity should not be considered as a topic apart from the core curricular components, lest it should be viewed as marginal to the role of engineers and other professionals, including those in the military area.

However, the topics in the documentary analysis undertaken seemed to point to the presence of a dominant, hegemonic discourse to the detriment of pluralistic views, as suggested by authors such as Ottewill *et al.* (2005). It should be noted that the interviewed coordinator of the mentioned Engineering course stated that the current official curriculum has been changed so as to cope with new demands. However, the referred interviewee mentioned that the new curriculum plan has still to be approved, thus some updates will probably occur. The coordinator also highlighted that the core of the document will certainly not change, which emphasizes that such a curriculum tends to show very little concern with multicultural education, the emphasis being on developing technical engineering concepts, understood as enough for a global perspective.

Concerning the content of the syllabuses in the two other civilian HEIs, it should be noted that they also seemed to emphasize the classical OR/MS approach (Canen & Canen, 2011), evidencing an absence of discussions concerning power relations, cultural diversity, qualitative and emotional factors affecting decision making and other issues brought about by multicultural thinking.

It is interesting to note that even though the syllabuses did not offer any articulation to multicultural sensitivities, the interviewees seemed to point out to an indirect (rather than explicit) sensitivity to the need to link those topics to a multicultural perspective in a global competence approach, as can be illustrated in the following excerpt:

> The technique I use in this course is based on interviews. That motivates the students to research, to find new ideas and solutions. I give the list of exercises, and they solve it in a group. Then, I interview each group, and each one of them defends their solutions while the others listen to them in silence… I also give them a test, because I found out that considering only that activity might be unfair… Once I gave a less than good grade to a young man, but then I realized he was shy, and that is why he could not have spoken out as well as others in that activity… In the test, he was great! (from the interview, March 2010, in Canen & Canen, 2011, p. 49).

The other interviewee from the second civilian HEI also seemed to evidence the need to take into account cultural diversity, as can be illustrated in the following vignette:

> What I deliver is a methodology, and that is the same all around the world. If I give a lesson in Arabic, or in Chinese – the methodology is the same. What should be directed to the local realities are the applications of that methodology. It is there that the international problems surface… In the Logistics part of the course the examples are more multicultural… I have to do that, because all of us have to sell products in places where other cultures exist, so that is the way we have to do it. (from the interview, February 2010, in Canen & Canen, 2011, p. 50).

From the above mentioned answer, it seems to be clear that even though the interviewee tended to understand the methodology as being "universalized", he conceded that its applications should be linked to discussions about cultural differences and dissonant voices, as suggested by authors mentioned in the last section.

We argue that linking technological syllabuses to a multiculturallly oriented perspective is possible and desirable in engineering curriculum, at all levels. It can represent a starting point for future initiatives and dialogues so as to further the aim of educating engineers (and other technological professions) for a global perspective that incorporates the valuing of diversity and the challenging of prejudices.

In fact, according to the framework presented in the first part of the present paper, we claim that subjects could be linked to a global perspective that nevertheless does not exclude a multicultural, inclusionary perspective – crucial for a world that needs more informed and transformational professionals in all areas.

At this point, it is worth stressing the western hegemony of mathematics whose origin took place in the Mediterranean. The historian Oswald Spengler had once mentioned that there is not one mathematics, one physics, but many, each different from each other (D'Ambrosio, 2002); consequently, the latter has shed light over the need to be aware of possible alternatives of mathematical approaches, depending on different cultural backgrounds.

According to D'Ambrosio (*op cit*) the "dominant mathematics" developed in western countries seems to have led those who domain it to present themselves with a superior profile and with the power to eliminate the daily mathematics.

In order to minimize such a kind of social construction and promote an educational work towards inclusion, this study argues for the need to articulate technological curricula to multicultural sensibilities. Therefore, multicultural competencies should be necessary in contemporary educational settings, in either civilian or military HEIs.

Such ideas should be added to technological curricula which aim at accomplishing syllabuses that develop a fair and equitable access to the Earth's resources as well as promoting the development of technology that sustains rather than degrades the natural environment, thus furthering a better human health, well-being and cultural diversity celebration (Cortese, 2003), and, therefore, better prepare for a global multicultural citizenship.

Conclusions

The present paper discussed the relevance of HEIs in embedding their curricula in a perspective that intends to professionally prepare future generations to be competent in a globalized world, in a multicultural and social inclusion perspective. It discussed theoretical aspects related to a possible framework to develop such an approach, as well as the extent to which that perspective informed (or did not inform) syllabuses inherent to an engineering curriculum in three HEIs in Brazil. The paper highlighted topics of the syllabuses analyzed, showing some possible illustrations of how they might combine with multicultural sensitivities.

In these turbulent times, engineers should broaden their knowledge beyond the strictly mathematical foundations. This article intends to be a call for educators of engineering and other technological areas to future collaboration, so as to promote educational research that should contribute to an ever increasing valuing of diversity for a more informed and transformational globalized competence, so as to make HEIs a site for the preparation of competent global citizens that are nevertheless attuned to the multicultural nature of that global world, and are ready to make it a more inclusive one.

References

Bickmore, K. (2011): Location, Location, Location: restorative (educative) practices in classrooms. Presented at *ESRG Restorative Approaches to Conflict in Schools*, Seminar, Moray House, School of Education, University of Edinburgh, Scotland, February.

Canen, A. G. & Canen, A. (1999): Logistics and Cultural Diversity: hand in hand for Organisational Success. *Cross Cultural Management*, Vol. 6, No. 1, pp. 3-10.

Canen, A. G. & Canen, A. (2001): Looking at Multiculturalism in International Logistics: an experiment in a higher education institution. *International Journal of Educational Management*, Vol. 5, No. 3, pp. 145-152.

Canen, A. G. & Canen, A. (2005): *Organizações Multiculturais*: *logística na corporação globalizada*. Rio de Janeiro: Editora Ciência Moderna.

Canen, A. G. & Canen, A. (2011): Management Science Education: a multicultural approach for higher education institutions in a plural world. *Social Sciences* (Kaunas), Vol. 71, pp. 46-52.

Carter, C. (2012): *Conflict Resolution and Peace Education: transformations across disciplines*. New York: Palgrave Macmillan.

Cortese, A. D. (2003): The critical role of higher education in creating a sustainable future. *Planning for higher education*, *31*(3), pp. 15-22.

Costa, R. P. (2012): The revolution in military affairs in the scope of military education. In D. Minchev, J. Baev, K. Grozev (Org.) *Technology and Warfare*. 1st Ed. Sofia: Urch Alma/Sofia University Press, Vol. 1, pp. 323-335.

D'Ambrosio, U. (2002): Etnomatemática e Educação. *Reflexão e Ação*: Revista do Departamento de Educação/UNISC. Vol. 10, No. 1. Santa Cruz do Sul: EDUNISC.

Ogunleye, J. (2011): European lifelong learning policies as applied to a particularly disadvantaged group. In Popov, N., Wolhuter, C., Leutwyler, B., Mihova, M. & Ogunleye, J. (Eds.) *Comparative Education, Teacher Training, Education Policy, Social Inclusion, History of Education,* Vol. 9, pp. 269-273. Sofia: Bureau for Educational Services.

Ottewill, R., McKenzie, G. & Leah, J. (2005): Integration and the Hidden Curriculum in Business Education. *Education and Training*, Vol. 47, pp. 89-97.

Rahim, M. A., Psenicka, C., Oh, S-Y., Polychroniou, P., Dias, J. P., Ferdausy, S. & Rahman, M. S. (2006): Relationship between Emotional Intelligence and Transformational Leadership: a cross-cultural study. In Rahim, M. A. (Ed.) *Current Topics in Management*, Vol. 11, Piscataway, NJ: Transaction, pp. 223-236.

Prof. Dr. Alberto G. Canen
Federal University of Rio de Janeiro
Brazil
agcanen@pep.ufrj.br

Prof. Dr. Ana Canen
Federal University of Rio de Janeiro
Brazil
acanen@globo.com

Rejane P. Costa
Brazilian Army Command and General Staff College
Brazil
rejpc@uol.com.br