

The Role of Cultural Diversity in Enhancing Engineering Education

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Abstract:

It is well known that diversity is in all schools of higher education. It is also noted that diversity in a school exists in faculty, students, staff and administration. Engineering schools and programs are no exception. The role of cultural diversity in enhancing engineering education is studied in this paper. An engineering student not only experiences diversity in the teaching faculty from whom he or she learns but also among the fellow students. The cultural background of people in an educational environment will play a significant role in the student's learning process. The cultural background of a faculty will express itself in the personality, behavior, expression, accent, etc. in a similar way a student's cultural background will also express itself in several ways. The interaction between an instructor (or faculty member) and a student from a two different cultural backgrounds will impact both the instructor and the student.

Introduction:

Diversity essentially refers to the dissimilitude among individuals. Although diversity is based on the differences among people, we know that in the context of an institution or an organization, it is the collaborative spirit and effort that leads to mutually beneficial outcomes. A university is a place that has a focus of educating students to become learned contributors to the profession and society. It is the responsibility of the university to prepare the students fully qualified to contribute in the global environment. It is well known that today's world is a global village due to rapid advances in communications, technology, international trade, etc.

The nature of diversity that can be seen clearly in the context of a university is cultural diversity. This is because the main focus of education though learning and teaching brings people as students and faculty from different societies together. The people as they come from different societies and their corresponding cultural backgrounds. Culture can be related to various intrinsic qualities and extrinsic expressions such as thought processes, habits, manners, emotions, communication skills, dress etc. Thus as people from very different backgrounds come together cultural diversity forms an essential characteristic of a university.

Today's world is connected by knowledge and is based on global economy. It is essential that a young graduate coming out of a university obtain necessary education and training in the school itself so that he or she will be efficient in dealing with the challenges due to existing cultural diversity in the world.

Cultural Literacy and Diversity

It is important to note that the nationality in terms of a person with his or her early childhood and schooling has a cultural influence in his or her skills and personality. This leads to diversity as the person grows to be an adult. Cultural diversity and cultural literacy are very closely connected. If an adult in his or her early childhood is exposed through education and experience to the cultural diversity in the world then the adult would have the necessary background to deal with the cultural diversity in both professional and social life. In the book *Cultural Literacy: What every American needs to know*, Hirsch, Jr., refers to an interesting experiment. The relevant material by Hirsch, Jr., is reproduced below¹.

“The national character of the knowledge needed in reading and writing was strikingly revealed in an experiment conducted by Richard C. Anderson and others at the Center for the Study of Reading at the University of Illinois. They assembled two paired groups of readers, all highly similar in sexual balance, educational background, age, and social class. The only difference between the groups was that one was in India, the other in the United States. Both were given the same letters to read. The texts were similar in overall length, word-frequency distribution, sentence length and complexity, and number of explicit propositions. Both letters were on the same topic, a wedding, but one described an Indian wedding, the other an American wedding. The reading performances of the two groups – their speed and accuracy of the comprehension – split along national lines. The Indians performed well in reading about the Indian wedding but poorly in reading about the American one, and the Americans did the opposite. This experiment not only reconfirmed the dependence of reading skill on cultural literacy, it also demonstrate d its national character.”

Thus we can see that cultural literacy need to be based on universal view. Again to quote Hirsch, Jr., about the importance of universal literacy¹

“ ..No modern society can hope to become a just society without a high level of universal literacy. Putting aside for the moment the practical arguments about the economic uses of literacy, we can contemplate the even more basic principle that underlies our national system of education in the first place – that people in a democracy can be entrusted to decide all important matters for themselves because they can deliberate and communicate with one another...”

In the report on “Dialogues for Diversity” based on a project on campus community and diversity several aspects of diversity such as campus mission about diversity, social impact, quality, campus climate, student development, ethnic identity, faculty role, leadership, etc are discussed. Some of the suggestions that are made in the report are very interesting and are noted below².

- Introduce multicultural content in the basic liberal arts curriculum.
- Develop student exchanges and other links with institutions in Latin America, Asia, and the Caribbean.
- Ask technical faculty to introduce ethnic-related topics, projects and texts wherever possible.
- Develop leadership programs for professionals working in multicultural settings.

Cultural Diversity and Engineering Education

It is important to note that there are several values derived from education of cultural diversity namely economical, social, political etc. directly influences engineering education. In a paper³ on “Globalization

of Engineering Education”, Buckeridge emphasizes a growing concern related to diversity that there is a growing need to adopt a universal consistency in engineering education, i.e. one that extends beyond the traditional Washington Accord which exists for developed, English speaking nations. The Washington Accord, drawn up in 1988, is an agreement between the professional engineering bodies of Australia, Canada, Eire, Great Britain, New Zealand and United States of America. More recently, this has been expanded to include Hong Kong-China and South Africa. The Accord serves to benchmark both the engineering degrees and the path to professional registration between the signatories. The net result has been a partial internationalization of the profession, such that appropriately qualified members of one Professional Engineering Institution be admitted, upon application, to the relevant grade of membership of another Institution within the Accord without further examination or interview. The underlying rationale for the agreement was the high level of mobility of today’s professional engineers and the international delivery of engineering services³.

The students in engineering educational institutions come with diverse background such as technological, cultural, economical, social, environmental, etc. The engineering educational curriculum of an institution should take into account of these various factors. Cultural diversity with various factors is like a complex system. In their paper⁴ on approaching cultural diversity through the lenses of systems thinking and complexity theory, Terrikangas and Hawk conclude that diversity has been a key component throughout human history. The scientific revolution has enabled today’s global interconnectedness between people from all over the world. In sum, it seems clear that current management paradigms that rely on Western rational approaches to philosophy and science are inappropriate to grasping the complexity of the contemporary world. It is equally clear that restricting oneself to a mono-cultural viewpoint with strict rationality will not help to understand the diversity in the human experience in a complex world⁴.

In a paper⁵ on an integrated approach to creating student-awareness, pedagogy and efficient management of multi-cultural teams in engineering projects presented at this meeting authors Bhate, Prasad and McCusker suggest that three key educational components to be integrated are the global awareness (world is flat), knowledge of all aspects of diversity and wisdom from other cultures such as eastern cultures (for example: BhagavadGita). It is important to note that engineering graduates in today’s world not only need multi-disciplinary technical skill but also multi-cultural people’s skill.

In a paper⁶ on the future of engineering education I A vision for a new century, Rugarcia, Felder, Woods and Stice identify seven features noted below that will pose challenges to future engineers.

- Proliferating Information
- Multidisciplinary technological development
- Globalized markets
- Endangered environment
- Emerging social responsibility
- Participatory corporate structures
- Rapid changes

It can be seen that cultural diversity plays a major role in all these above features. Thus the engineering curriculum should account for these and possibly more features in providing vision, knowledge, and skills to the graduates to successfully contribute to the world.

Engineering Students and Cultural diversity

The cultural diversity among students, among faculty and among staff at an institution directly influences the process of education. However in this work diversity among students and faculty is studied through an in-class survey by a junior level machine-design class. The class has students from diverse cultural backgrounds. Two surveys were done from students. The first survey is about the influence of cultural diversity among faculty on the students in their engineering education. The second survey is about the influence of cultural diversity among fellow students on the students in their engineering education. The purpose of these two surveys was to obtain a feel for the impact of cultural diversity on engineering students in their engineering education. Each survey has five questions. Each question had evaluation scores of 0, 1, 2, 3 and 4. The score 0 indicates that students perceive the cultural diversity in faculty as least helpful in their engineering education and a score of 4 indicates that students perceive the cultural diversity in faculty as most helpful in their engineering education.

Survey One: The questions and resulting scores of the first survey (on the influence of cultural diversity among faculty) based on 35 students are given below.

The cultural diversity in faculty is

a) enabling me to understand material in classes better	1.63
b) helping me to ask question in class	1.51
c) helping me to meet instructor in person to ask questions outside the classroom	1.97
d) providing me the global experience and nature of engineering profession	3.41
e) helping me due to variation in the type of course examinations and assignments	2.06

It is seen that the students feel that the cultural diversity among faculty is mainly helping them to obtain global experience in context of engineering profession. Thus we see that in addition to the engineering knowledge, the students also obtain global experience as they are influenced by the various cultural expressions of the faculty.

Survey Two: The questions and resulting scores of the second survey (on the influence of cultural diversity among fellow students) based on 35 students are given below.

The cultural diversity among my fellow students is

a) enabling me to understand material in classes better	1.79
b) helping me to ask questions in classes	1.76
c) helping me to study with friends outside the classroom	1.71

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| d) providing me the global experience and nature of engineering profession | 2.97 |
| e) helping me to work harder to obtain higher grades | 1.86 |

In this survey we see a similar feeling that students are obtaining global experience through the cultural diversity among their fellow students. Also we see by comparing the two surveys that the students are experiencing better educational environment with cultural diversity among their fellow students than the cultural diversity in the faculty. This is to be expected given that the interaction between students in their campus life is more than that with faculty.

Concluding remarks

However, based on this simple survey, we see that the overall impact of cultural diversity either in the faculty or in the student body is not big. This indicates that more pro-active environment needs to be created in the classroom and campus. Although it is felt that the engineering education is not heavily influenced by the cultural diversity, it is essential that university administration, faculty and staff use the inherent cultural diversity existing in campus to the advantage of engineering educational experience of students. The professional society chapters such as American Society of Mechanical Engineers, Society of Automotive Engineers, Engineers without Borders, etc., can be used to bring both engineering education and experience of cultural diversity together.

All the studies related to diversity indicate that globalization due the technological development around the world is unavoidable. It is essential that all efforts are made at all levels in an institution to enhance the engineering education through the good use of cultural diversity. This can only help producing graduates better prepared to efficiently face challenges both in engineering profession as well as in personal life.

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