

AC 2007-1454: LINKING INTERNATIONAL COMPETITION, INNOVATION, CULTURAL UNDERSTANDING AND GLOBAL THINKING: MOTIVATING TECHNOLOGY STUDENTS TO BE ATTENTIVE TO CULTURAL ISSUES

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Linking International Competition, Innovation, Cultural Understanding and Global Thinking: Motivating Technology Students to be Attentive to Cultural Issues

Introduction:

The former Federal Reserve Chairman, Allen Greenspan, in his address to the 2004 Boston College Finance Conference argued that the key to preserving US jobs was not protectionism, but education and training to ensure that Americans are able to thrive in a global economy: "As history clearly shows, our economy is best served by full and vigorous engagement in the global economy... Consequently, we need to increase our efforts to ensure that as many of our citizens as possible have the opportunity to capture the benefits that flow from that engagement¹." The urgency with which this "vigorous engagement" has to be pursued in the area of technical education is apparent from remarks made by William Wulf, in his Presidents Speech to the National Academy of Engineering in 2003, in which he concludes with this advice: "Our society is dependent upon technology created by engineers. Engineering is changing rapidly, and I believe engineering education has to change even faster for us to maintain our quality of life. We've studied it to death. We know what to do. So let's get on with it!"²

Rapidly changing technological ecosystems demand that students in science and technology prepare for the growing impact of globalization. Teaching issues like cultural diversity to technical students can be a hard sell; it is not enough to say that ABET requires it, or that "Engineer 2020" desires it. We can provide lists of reasons why certain organizations and task forces have come to see cultural understanding as an essential part of technical education. Still many technical students remain skeptical about the need to study topics not directly related to their specializations in technology. This kind of skepticism can be allayed in a classroom situation if students can be guided, through case studies, to comprehend the connection between innovation and cultural understanding in a global economy. There are two case studies, of dissimilar products, that are particularly effective for illustrating the importance of cultural diversity: an Intel proposal for "community PC" in rural India; and Apple's continued development of the iPod series. Apple's iPod, designed by an American company for an American consumer, was chosen because of its immense popularity among students; it forms a case study of a familiar product in a familiar place. For the unfamiliar, we chose Intel's "community PC." This global venture has prospects that are not immediately apparent without taking into consideration the economic potential of India. It would be possible to choose any number of other products or markets, the main consideration being that something outside the students' own area of familiarity be brought to the table. In this case, the product to be studied is appropriate to the expertise of students in the target class, and the authors have knowledge of the Indian market conditions so as to best help students understand the complexities of selling technology there.

This paper will begin by discussing both the case studies briefly in the context of the "6 P's" model of innovation³ (people, product, price, place, promotion and process; © Copyright 2005,

Oregon Innovation Center), and will then describe how the case studies were used in an actual classroom setting. Results from surveying the two separate classes will be presented, analyzed and assessed with an assessment component using outcomes identified by Global Engineering Education (GEE) group⁴.

The Products:

Intel Corporation, based in Santa Clara, California, is the world's largest chip maker. Intel Corporation has recently initiated two innovative projects⁵⁻¹⁹. The first is a collaboration with Microsoft Corporation to deliver flexible pay-as-you-go PC purchasing for consumers in emerging markets such as India. The pay-as-you-go model, enabled by FlexGo, would make PC's more accessible by reducing the cost of computers and enabling customers to pay for computers through subscriptions or as they use them through prepaid activation cards or tokens¹⁰. Intel's second project is a one billion dollar, five-year World Ahead Program⁸ (WAP) with India. Intel said the company would provide free training in computer technology for 800,000 Indian teachers over the next five years¹⁴.

The [iPod](#)²⁰⁻²² was originally designed as a single-purpose device to store and to play digital music. The device is currently being marketed with the enormously successful iTunes, aimed at teenagers and young people in their twenties, iPod devices are tasteful and elegant. Table 1 is a comparative look of the innovative considerations for the Intel PC with the iPod.

Class Presentations:

The authors have used the two case studies to demonstrate differences in innovative considerations for the two products in their respective marketplaces. While the presentation was intended for engineering technology students it was first offered to a calculus class. The class consisted mostly of students, majoring in engineering technology, aviation, and technology management, although some students were undeclared. The calculus class was selected because engineering technology courses were not available during the summer, and the class sample was sufficiently technical.

The presentation began with a discussion of the growing importance of global thinking to US industry. Students were encouraged to interrupt at anytime during the presentation. A short break was taken to pass out Indian sweets while classical Indian music was played to a slide show of the Taj Mahal in an attempt to create a sensory-rich experience prior to talking about Intel's Community PC. A break was also taken to pass out candy with American music playing in the background before the iPod discussion. While no attempt was made to measure the impact of the sensory experiences provided, we hoped it would make for a more interesting presentation and help keep the audience awake. After a question and answer session, a survey was handed out. More or less the same process was followed in an engineering technology seminar course for our second survey which was taken in the Fall semester of the same year.

Table 1
6P's Considerations3 - 21

Innovation	People	Product	Price	Place	Promotion	Process
To provide low cost digital accessibility in India providing affordable PCs tailored to regional needs.	Important people consideration include the per capita income \$620 in 2003. One quarter of population live. 390 million people live on less than a dollar a day.	Personal Computers that provide digital access tailored to meet regional needs.	The PCs would have to be made affordable by a combination of measures that involve lower manufacturing costs, and innovative schemes like subscriptions or usage based payments.	India lags behind in rural electrification and as such computers will have to be designed for battery operation with low power consumption.	In the World Ahead Program (WAP) Intel provides free training to 800,000 teachers. Other incentives to buy include connectivity and features tailored to regional needs.	Intel's approach to this process has required it to pay attention to the 6P's. The presence of an innovation process is able to generate a growing demand and will provide crucial information for similar ventures in other parts of the World.
The iPod was originally designed as a single-purpose device to store and play digital music. The iPod is currently being marketed with the enormously successful iTunes.	Target people are more likely to include teenagers and the twenty something block. The iPod devices are tasteful and elegant. It definitely possesses a "coolness" factor and helps project certain image.	Early iPods had clear form factor and ease of use advantages versus their competitors.	iPod devices sell from about \$70 to about \$350. Gauging by the success of the product this is an affordable range for young consumers with disposable income.	Marketed to the US customer.	Multimedia advertising that is guaranteed to reach target audience.	The iPod devices continue to make market gains. Integration with iTunes has resulted in huge benefits for Apple. The product is now jointly being marketed with Nike shoes using a shoe sensor.

Survey Data:

Tables 2(a) and 2(b) are responses to our two separate surveys.

Table 2(a) Globalization Survey to Calculus Class				
Statements	Level of Agreement Highest level of agreement → 3 Lowest level of agreement → 0			
	Students responding 0	Students responding 1	Students responding 2	Students responding 3
1. Studying people and cultures are important to the innovation process in a global economy.	None	None	5	17
2. In marketing a product the geographic realities must be taken into consideration e.g. whether or not electricity is available in a region where an electronic gadget is to be sold.	None	None	2	19
3. The average national income would be a key factor for setting a price for the product.	None	2	3	17
4. Intel's decision to market \$220 PC's to India is a good business decision.	3	7	9	1
5. India's workers associated with the development of the Intel project were hired because they required lower wages and provided useful cultural perspectives	3	11	6	2
6. As time goes the United States will become embedded in a global economy.	None	None	9	13
7. Globalization is a reality that we must all deal with.	None	1	3	17
8. We should fear globalization unless we prepare for it.	6	9	4	3
9. The Nike-Apple iPod product would not be suited for poorer countries.	1	2	8	11
10. Experiencing music of another culture can help us in business dealings with that particular culture.	3	12	5	2

Table 2(b) Globalization Survey Engineering Technology Seminar				
Statements	Level of Agreement Highest level of agreement → 3 Lowest level of agreement → 0			
	Students responding 0	Students responding 1	Students responding 2	Students responding 3
1. Studying people and cultures are important to the innovation process in a global economy.	None	3	12	26
2. In marketing a product the geographic realities must be taken into consideration e.g. whether or not electricity is available in a region where an electronic gadget is to be sold.	None	1	7	33
3. The average national income would be a key factor for setting a price for the product.	1	1	11	28
4. Intel's decision to market \$220 PC's to India is a good business decision.	3	6	15	17
5. India's workers associated with the development of the Intel project were hired because they required lower wages and provided useful cultural perspectives	6	10	19	6
6. As time goes the United States will become embedded in a global economy.	None	3	15	22
7. Globalization is a reality that we must all deal with.	1	2	9	29
8. We should fear globalization unless we prepare for it.	9	15	12	5
9. The Nike-Apple iPod product would not be suited for poorer countries.	3	2	14	22
10. Experiencing music of another culture can help us in business dealings with that particular culture.	4	9	21	7

Analysis of data:

Table 3 provides results for the second survey. Each survey statement is examined in the context of certain Global Engineering Education (GEE) student outcomes. *While the outcomes are not a result of the fifty-minute presentation, the table does help identify areas where student growth is needed.* The first GEE Symposium⁴ suggested the following student outcomes for continuous improvement (while originally a bulleted list, we transformed it into a lettered list for convenience of analysis):

- a. Competition in job market
- b. Cross-cultural fluency
- c. The ability to place knowledge within a social context
- d. Demonstrate globalized technical knowledge
- e. Adaptable to new environment
- f. Improved communication skills
- g. Awareness of relevant factors in a global economy
- h. Increased disposition to work in a global economy
- i. Synthesis of engineering and culture and communication technology subsystems

If we decide to use an 80% agreement as the indicator of a successful achievement of an outcome, and if each survey statement judges one instance of success or failure in accomplishing all related outcomes, we can then calculate and plot the number of instances each outcome succeeds or fails (Fig. 1). For example, the agreement level with statement 1 of the survey was 100% for calculus students and 93% percent for ET students (Table 3). Responses to statement 1 have been taken as a single instance of success for GEE outcomes b, c, f, g, h and i. Similarly responses to statement 3 have been taken as a single instance of failure for outcomes e, g, and i. While there is a small variation between both renditions of the survey the overall numbers of instances of successes and failures of each GEE outcome is the same.

Statements	Related GEE suggested student outcomes									Agreement level (2's and 3's) in %	
	a	b	c	d	e	f	g	h	i	CAL	ET
1. Studying people and cultures are important to the innovation process in a global economy.		X	X			X	X	X	X	100	93
2. In marketing a product the geographic realities must be taken into consideration e.g. whether or not electricity is available in a region where an electronic gadget is to be sold.				X			X	X		100	98
3. The average national income would be a key factor for setting a price for the product.							X			90	95
4. Intel's decision to market \$220 PC's to India is a good business decision.					X		X		X	50	78
5. India's workers associated with the development of the Intel project were hired because they required lower wages and provided useful cultural perspectives	X	X	X		X		X	X	X	36	61
6. As time goes the United States will become embedded in a global economy.	X				X		X	X		100	90
7. Globalization is a reality that we must all deal with.	X				X		X	X		95	93
8. We should fear globalization unless we prepare for it.	This statement on reflection was considered confusing and will not be a part of further analysis									32	41
9. The Nike-Apple iPod product would not be suited for poorer countries.		X	X		X		X		X	86	87
10. Experiencing music of another culture can help us in business dealings with that particular culture.		X	X				X			32	68

Fig. 1 should not be used to assess the success of the presentation. Indeed, what the presentation accomplishes is a **dialogue** with students regarding **globalization**; the survey provides

information regarding student **knowledge and attitudes** in the area. The knowledge and attitudes of students have undoubtedly been shaped by their life experiences leading to the survey. The impact of the fifty-minute presentation could have been gauged properly with a before and after survey. Fig. 1 shows that *students are open to the prospect of working in a global economy (GEE outcome h)*.

Analysis of table 2 also reveals an interesting result. Students agree unanimously with statement 1, about the importance of studying people and cultures to the innovative process, while at the same time they tend to think that the cultural perspectives of Indians hired by Intel as not important (statement 5). *While students seem to value their own cultural perspectives they do not seem to think that the perspectives of the indigenous populations can also be useful; this disconnect needs to be addressed.* On closer examination it would appear that ET students had a higher level of agreement with statements 4, 5, and 10 (while both groups failed to sufficiently agree). One possibility is that the authors did a better job of presenting the case during their second presentation. If this is indeed the case, it would seem to indicate that global attitudes can be influenced positively through case studies.

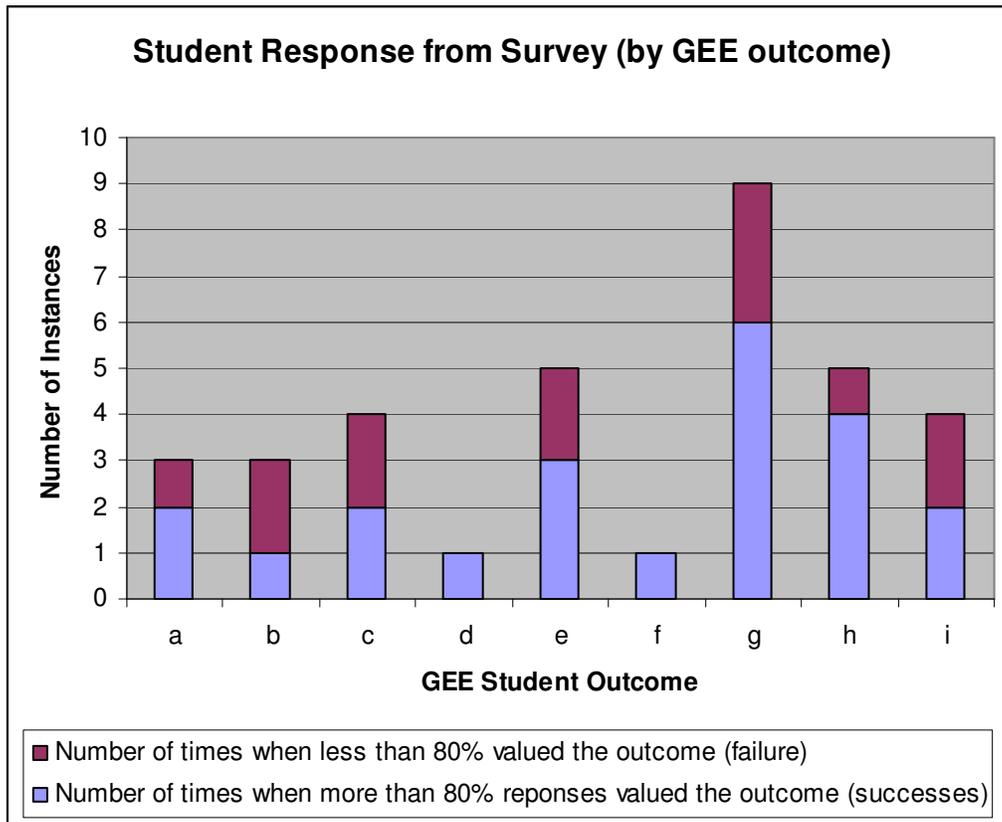


Fig.1. The height of the bars indicate how many times a survey statement was made that related to a particular GEE outcome (mapped from Table 3). Blue portion indicates the number of times responses that seemed to value the outcome and the maroon portion part indicates the number of times it did not seem to be valued by at least 80% of students.

Summary:

In the future, we need to look more closely at the differences that exist between the two groups in their responses to survey statements 4, 5, and 10. In both cases, less than 80% of students had an agreement level that was two or greater; there remains is a significant variation that needs to be explained. While the same presenters were responsible for the both presentations, a more tightly controlled presentation for the two groups may be a way to reveal discrepancies. We believe it would be helpful to administer a pre-survey prior to the presentation using general statements that touch upon GEE outcomes. The post survey may help clarify the impact of the presentation itself.

We have been in the business of promoting diversity for some time now. We are all too aware of the negative reaction some students have: “why do I need to know this?” It is our belief that attitudes about exposure to issues like cultural diversity can be influenced positively by teaching it as an essential component of globalization. We selected two case studies, a familiar scenario, and an unfamiliar one. The US was selected as the familiar place and India was chosen as the unfamiliar location for reasons that include growth patterns and author experience. The survey conducted after the presentation actually supports this idea (Statement 1, table 2). All respondents agreed with the premise that “studying people and cultures are important to the innovation process in a global economy.” Further analysis of data reveals the encouraging result that students demonstrate an understanding that they will be working in a global economy (Fig. 1, GEE outcome h).

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