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Changing Attitudes in Cross Cultural Diversity through International Senior Capstone Projects

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Julia Ziyatdinova graduated from Kazan State Pedagogical University in 1999. Her major areas of study were foreign languages and she finished her University course with honors and qualification of teacher of English and Turkish. She continued her training and obtained PhD in Education degree in 2002. The topic of her PhD study was titled "System of Character Education in the US Schools: Current State and Trends for the Development". She also received additional minor degrees in Management (1998) and Psychology (1999) in Kazan State Technological University.

Julia joined the team of Kazan State Technological University as an instructor at the Department of Foreign Languages and the School of Foreign Languages "Lingua" in 1999 and was rapidly promoted to the position of Associate Professor at the Department of Foreign Languages in 2003. Her teaching career was perfectly balanced by the experience of a translator and an interpreter. She is a well-known person at Kazan international conferences and other events for her high quality consecutive and simultaneous interpreting, such as interpreting for the Academy of Sciences of the Republic of Tatarstan.

The new milestone in Julia's career was the position of the Chair of Department of Foreign Languages for Professional Communication in 2007, when she took over all the responsibilities related to foreign language training at Kazan State Technological University. The teaching and research priorities of her department were then focused on professional and intercultural communication for students in a technical university, professional translation and creation of foreign language environment at a university.

Because of her talents and activities, Julia became one of key figures in university international life. When Kazan State Technological University obtained the new status of a National Research University and joined the list of Top 30 Russian universities, Julia was offered a position of a Head of University International Office. She took over this position in April 2011 and rapidly gathered a strong team of professionals to face the challenges of the new university status and transformed International Office into University International Affairs with two offices covering all the aspects of internationalization.

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Base Lining Cross Cultural Diversity Attitudes in International Senior Capstone Projects

Abstract

In this global world, today's engineer is likely to have to work in global international teams with colleagues from other nationalities. The challenge for many engineering curricula is how to include, in a realistic way, this global dimension and increase the student's awareness of the issues that are encountered.

In the Purdue University Engineering Technology program, an international capstone project was created to increase student awareness of the cultural differences that they will encounter in global projects. This international capstone project builds on the existing, industry sponsored, multi-disciplinary capstone team project that is required of all students.

In order to assess whether this approach can increase awareness in global cultures, the MGUDS-S form which assesses cross cultural diversity was used to assess cultural awareness and sensitivity. Ultimately this form is being used to evaluate whether the international senior capstone project approach can impact a change in cross cultural diversity. This study explores the existing differences in the populations that involved in existing on-going multinational projects—projects with students from Germany and Poland. Furthermore this study also attempts to evaluate the response to this survey tool from a population of experienced business and technical global professionals. This survey group included participants from fourteen countries from Europe, North and South America, Africa, and Asia. The goal for this portion of the study was to evaluate the areas where the student population has areas that need improvement compared to experienced global professionals and help to guide the program.

Several significant differences were identified across the study populations as well as about the tool. The use of the word "race" was found to be objectionable in Germany. Across the populations, The MGUDS-s pointed out that all students show much lower interest than experience professionals in participating in diverse social and cultural activities and appreciating the impact that diversity can have on self-understanding and personal growth. In contrast, the survey data indicates that the student populations consistently were as emotionally comfortable and at ease with diverse cultures as the more mature professional population.

Background

In this global world, today's engineer is likely to have to work in global international teams with colleagues from other nationalities and cultures. Considerable effort has been made to define the attributes and competencies of a global engineer[4,5] and the paper will not attempt to review this body of research. Many of these attributes are well recognized prior to the concept of a global engineer. However several attributes stand out with more emphasis and significance in the global world of the practicing engineer. Parkinson conducted a survey of the 2008 NSF Summit on Globalization during which the top five competencies were identified. Among these were an appreciation of other cultures, an ability to communicate across cultures and in other languages, an ability to work in cross cultural teams and deal with ethnic and cultural diversity and having an international work/educational experience.[6] In addition the global engineer must have a higher standard of competency in the broad range of electronic communication tools over the internet and over a broad range of ethical and professional standards which includes a sensitivity to norms other than one's own country. These attributes among others take on new dimensions when put in the global context. At the root of these attributes is the heightened awareness of

global cultures and a sensitivity to the cross cultural nature of an engineer's profession. The challenge for many engineering curricula is how to include this global dimension in a realistic way.

One of the most common approaches to increasing global awareness in engineering programs is the traditional study abroad programs typically one or two semesters long. However many undergraduate students do not have the opportunity to travel abroad and experience and develop communication skills with others cultures. For many students with rural roots in the farmland of the American midwest, the idea of travel abroad is not in their educational vision and such an experience is not in their comfort zone to explore. There are many examples in the literature of undergraduate activities and course sequences that strive to increase global awareness other than traditional study abroad experiences: a two course sequences with a one semester project[7] with teams formed from two cultures (Sweden, China, USA), a six week capstone project with dual cultural teams[8] (USA, Mexico), 6-12 week internships working in German laboratories[9](German, USA)9 and a year-long capstone project with three cultures (USA, Romania, Brazil)[10]. Among the lessons learned from these activities are the following elements for success: limit the diversity of time zones[6], introduce language, even in condensed form, to enhance the cultural experience[7], and utilize graduate students in active mentorship of visiting students.

In the School of Engineering Technology capstone projects are one of the most effective avenues to synthesize an engineer's education and therefore present themselves as an opportunity to insert global awareness. Accreditation bodies including ABET (Accreditation Board for Engineering and Technology) require such an experience in the curriculum particularly in (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context and "j": "a knowledge of the impact of engineering technology solutions in a societal and global context."[1] In the School of Engineering Technology, a very successful program of industry funded, senior capstone team projects exists as a requirement for graduation. In 2014-2015 teams of mechanical engineering technology and electrical and computer engineering technology students are addressing 33 projects on a broad range of topics. Some representative and typical projects that can be accomplished are listed in reference 2 [2]. All the projects are real world projects sponsored by industry working on open ended problems resulting in a design, build and test experience. Both academic and industry mentors are provided with weekly interactions with a series of reviews based on a modified stage/gate development process.

Into this well developed and stable senior capstone project process, an international capstone project has been created and introduced in 2014-2015. This international capstone project builds on the existing, industry sponsored, multi-disciplinary capstone team project that is required of all students. In the international project, half of the team members are students from a non-US university. The full team works on a project proposed by companies with a global footprint in both the U.S. and in proximity to the foreign institution. Course materials include standard project management and systems engineering tools and are augmented with cultural and business practice research and reporting. Most of the global project is carried out using the full range of electronic communication tools such as email, skype, and blogs. In a variation from many of the other non-traditional activities, two exchange trips are made with team members traveling to their opposite foreign location. Ideally the first trip occurs near the initiation of the project for planning, organizing and conceptualization. This early face to face meeting has been found to facilitate the formation of personal relationships that endure during the project execution and enhance both the outcome of the project and the cultural experience. To further enhance the experience, during each visit, the visiting students are lodged with the host students for a total emersion into the culture of the country. The framework of this international capstone project addresses key variables identified as necessary for maximum impact: customers and co-workers in both countries, project definition by the customer and the requirement for demonstration/presentation to the customer.[11]

One of the challenges is the synchronization of two institutions regarding two curricula and academic schedules. Despite the challenges of schedule and culture and the intuitive sense that this type of

experience would increase global awareness, it is desirable to measure the impact and efficacy of the program. This study surveys attitudes of students from the participating countries including the U.S students setting a starting point and second, attempts to baseline attitudes from global professional thereby setting a reasonable goal and identify areas where the students need specific growth.

Assessing Cross Cultural Diversity

There exist already several survey tools to evaluate various aspects of cultural attitudes. The Miville-Guzman Universality-DiversityScale (M-GUDS)-S in its trimmed version was selected for this broad survey[12] because this tool focuses on areas that would be relevant to measure a change in attitude as a result of curriculum changes. Additionally this tool was used in studies with similar goals and found to be useful.[14,13] While this study focused on attitude change, future consideration will be given to tools that focus on assessing acquired skill and the ability to act in appropriate manner consistent with the improved attitude. The original Miville-Guzman Universality-DiversityScale (M-GUDS) was a 45-item instrument designed to measure an individual's Universal-Diverse Orientation (UDO), defined as ''an attitude of awareness and acceptance of both similarities and differences that exist among people''. This 45 item tool has been modified and trimmed to 15 items which requires less time and has been shown to be as effective[3]. In the original tool, as in the compressed tool, groups of questions are used to create three subscales to assess behavioral, cognitive and emotional dimensions of UDO. The subscales and the questions used to form the subscales are shown as follows:

1) <u>Diversity of Contact</u> – the students' broad interest in participating in diverse social and cultural activities such as music, dance, celebrations and organization which focus on behavior.

   1. I would like to join an organization that emphasizes getting to know people from different countries.
   2. I would like to go to dances that feature music from other countries.
   3. I often listen to music from other cultures.
   4. I am interested in learning about the many cultures that have existed in this world.
   5. I attend events where I might get to know people from different cultural backgrounds.

2) <u>Relative Appreciation</u> – the extent that diversity could have on self-understanding and personal growth which is a cognitive element

   1. Persons with disabilities can teach me things I could not learn elsewhere.
   2. I can best understand someone after I get to know how he/she is both similar to and different from me.
   3. Knowing how a person differs from me greatly enhances our friendship.
   4. In getting to know someone, I like knowing both how he/she differs from me and is similar to me.
   5. Knowing about the different experiences of other people helps me understand my own problems better.

3) <u>Comfort With Differences</u> – the degree of emotional comfort with individuals of a different culture (Note that these items are reverse scored)

   1. Getting to know someone of another culture is generally an uncomfortable experience for me.
   2. I am only at ease with people of my culture.
   3. It's really hard for me to feel close to a person of another culture.
   4. It is very important that a friend agrees with me on most issues.
   5. I often feel irritated with persons of a different culture.

The MGDUS-s survey uses a six-point Likert scale ranging from strongly disagree to strongly agree and was initially found to be a good fit with our study. As a result of using this survey, some of the wording in the survey questions has been found to create cross cultural issues. However, with the extensive

development that supports this survey, the MGFUDS-S was adopted for this study with only slight modification.

Populations of the Study

In the present international senior capstone projects, half of the team members are students from a non-U.S. university. The full team works on one integrated project proposed and sponsored by companies with a global footprint in both the U.S. and in proximity to the foreign institution. The first two international teams are as follows: 1)Purdue University with the Leibniz University of Hannover sponsored by Lenze Corporation and 2) Purdue University with Gdansk University of Technology sponsored by Eaton Corporation. Most of the global project is carried out using the full range of electronic communication tools such as email, skype, and blogs. In addition two exchange trips are made with team members traveling to their opposite foreign location. Ideally the first trip occurs near the initiation of the project for planning, organizing and conceptualization. This trip took place in October 2014 with the Lenze team and will take place in March 2015 for the Eaton team. As a result of these projects, data using the MGUDS-S survey was collected from these populations:

- the full senior engineering technology capstone class at Purdue of 109 students,
- a subset of that class which was the students who are participating in the international capstone experiences (7 students),
- the third year class of 42 electrical engineering students at Leibniz University of Hannover,
- the third year class of 117 mechanical engineering students at Gdansk University of Technology and finally
- the professional participants in the Global Village on The Move program held in Kazan, Russia.

The latter group is made up of experienced professional business people and entrepreneurs from around the world including Russia, Mexico, Luxembourg, Australia, South Africa, Uzbekistan, Brazil, and Finland. This international group has quite different demographics than the other groups and is being used as a reasonable benchmark for broad minded professionals already fully aware of the potential benefits to cross cultural interactions. Furthermore the differences from this group and groups of students from several countries could be used to guide efforts to change student attitudes. The comparison between nationalities further supports specific areas where diversity could be troublesome and where course structure could be altered to address the functional effect in these areas. In addition to the survey questions, anonymous demographic information was collected. A summary of the demographics of the

	American	Polish	German	GVOTM professionals	Total
Male	88.30%	64.96%	78.57%	31.82%	72.70%
Undergraduate	98.94%	99.15%	64.29%	9.09%	86.88%
International Students	7.45%	0.00%	26.19%	31.82%	8.87%
More than one Language	60.64%	95.73%	92.86%	95.45%	82.98%
Study Abroad	31.91%	17.09%	45.24%	59.09%	30.14%
Sample Size	94	117	42	22	281

Table 1 Demographics of the four sampling groups

Question Specific	Average	Sigma	Average	Sigma	Difference	Sigma Diff
1. I would like to join an organization that emphasizes getting to know people from different countries	4.36	1.20	5.73	0.46	1.37	20.40
2. Persons with disabilities can teach me things I could not learn elsewhere	4.56	1.06	5.27	1.03	0.71	11.67
3. Getting to know someone of another race is generally an uncomfortable experience to me	1.91	1.07	2.05	1.68	0.14	2.11
4. I would like to go to dances that feature music from other countries	3.69	1.46	5.00	1.07	1.31	15.89
5. I can best understand someone after I get to know how he/she is both similar to and different from me	4.46	0.98	4.82	1.33	0.36	6.23
6. I am only at ease with people of my race	2.08	1.09	1.45	0.96	0.63	10.12
7. I often listen to music of other cultures	3.91	1.44	4.91	1.23	1.00	12.26
8. Knowing how a person differs from me greatly enhances our friendship	4.05	1.19	4.23	1.66	0.18	2.56
9. It's really hard for me to feel close to a person from another race	2.00	1.05	1.50	0.91	0.50	8.37
10. I am interested in learning about the many cultures that have existed in this world	4.50	1.17	5.45	1.30	0.95	14.02
11. In getting to know someone, I like knowing both how he/she differs from me and is similar to me	4.44	1.02	5.00	0.87	0.56	9.60
12. It is very important that a friend agrees with me on most issues	3.28	1.33	3.55	1.57	0.27	3.45
13. I attend events where I might get to know people from different racial backgrounds	3.93	1.41	5.18	0.80	1.25	15.78
14. Knowing about the different experiences of other people helps me understand my own problems better	4.42	1.23	5.41	0.50	0.99	14.34
15. I often feel irritated by persons of a different race	2.15	1.20	1.55	1.10	0.61	8.81

Table 2 Full survey result comparing student attitudes to experienced professional attitudes

four populations is shown in Table 1.

Results of the Surveys

In analyzing the survey data, it was found that a clearer view of the data was presented by comparing the three subscale described in an earlier section and this approach has been followed in this paper. It was necessary to reverse the numerical values for the emotional comfort subscale since the questions in that subscale were stated in reverse response value.

In table 2 and 3, a comparison of the entire student population versus the professional group is made. As expected, on most levels, the students' diversity views are lower than the professional. Student and professionals are statistically close regarding emotional comfort with different cultures. However significant differences appear relative to behavior and cognitive appreciation subscales. This difference may be strongly influenced not only by professional experience but by an older and more mature

	Student Population		Professional Population	Difference
Diversity of Contact	20.38		26.27	5.89
Relative Appreciation	21.92		24.73	2.80
Emotional Comfort	23.57		24.91	1.34

Table 3 Comparison of Entire Student Population to Professional group according to subscales of diversity attitudes

	Study Abroad		None	Difference
Diversity of Contact	22.16		19.61	-2.55
Relative Appreciation	23.36		21.30	-2.06
Emotional Comfort	24.00		23.39	-0.60
	second language		None	Difference
Diversity of Contact	19.10		20.65	1.55
Relative Appreciation	21.14		22.08	0.95
Emotional Comfort	25.31		23.22	-2.09
	Male		Female	Difference
Diversity of Contact	19.54		22.63	3.10
Relative Appreciation	21.33		23.52	2.19
Emotional Comfort	23.55		23.85	0.30

Table 4 Analysis of demographic factors influencing the MGDUS-S survey

population.

The composite of the student groups was analyzed relative to multiple demographic factors: ability in a second language, participation in study abroad and gender in table 4. While the emotional comfort with other cultures appears to be similar across gender and experience abroad, the study abroad group appreciates the impact of cultural diversity and seeks it in a variety of activities. Emotional comfort with other cultures is significantly increased with ability in a second language. This data confirms experience with capstone projects where even a limited degree of language skill reduces anxiety and increases comfort. Clearly in our data, males are dramatically less active in seeking culture diversity and appreciating its impact on their development than are the female populations.

A comparison of the American to German undergraduates table 5 indicates that American students scored higher in all areas of cultural diversity, the largest variation being the emotional comfort with different cultures with still a large difference in appreciation for the impact of cultural diversity. Drilling further into the multiple questions in the emotional comfort category, the largest difference between German/American students comes from the question: "being at ease with people of another culture." This difference is reduced if German graduate students are included in the results suggesting an effect of aging and maturity. The data also suggests that, in the context of an international project, initial relationships may be more difficult between American and German students.

A comparison of the American to Polish undergraduates in table 6 indicates that the Polish and American students are very similar in attitudes to behavioral contact and appreciation of the impact of cultural differences. Interestingly these two groups differ significantly in the emotional comfort in crossing cultural lines. The data suggests that, in the context of an international project, relationships may be easier between American and Polish students while initial encounters may be more strained until relationships are created and emotional bridges established due to the higher emotional comfort of American students.

	American		German	Difference
Diversity of Contact	19.77		18.46	-1.31
Relative Appreciation	22.11		19.22	-2.89
Emotional Comfort	25.36		21.61	-3.75

Table 5 A comparison of attitudes to cultural diversity from American undergraduate students versus German undergraduate students.

	American		Polish	Difference
Diversity of Contact	19.77		20.10	0.33
Relative Appreciation	22.11		21.72	-0.38
Emotional Comfort	25.36		22.47	-2.89

Table 6 A comparison of attitudes to cultural diversity from American undergraduate students versus Polish undergraduate students.

	German		Polish	Difference
Diversity of Contact	19.38		20.10	0.72
Relative Appreciation	20.49		21.72	1.23
Emotional Comfort	21.59		22.47	0.88

Table 7 A comparison of attitudes to cultural diversity from German undergraduate students versus Polish undergraduate students

Finally a comparison between the German and Polish undergraduate students can be made. Given the results of the comparisons relative to American undergraduate students, the results in table 7 are not surprising.

The final aspect of this study must return to the original goal of the study: to give guidance to the development of curriculum and activities that address deficiencies in the preparation of engineering students. In tables 8 and 9 the American undergraduate students are compared to the group of international professionals. Clearly curricula that introduces the excitement of events and activities that form an integral part of other cultures is important. This conclusion is clear in the diversity of contact subscale on all five of the questions in this subscale. Furthermore increasing the awareness of engineering students to experiences in other cultures and understanding how these experiences may impact growth in their own lives could stimulate discussion and reflection.

	American		Professional Group	Difference
Diversity of Contact	19.77		26.27	6.50
Relative Appreciation	22.11		24.73	2.62
Emotional Comfort	25.36		24.91	-0.45

Table 8 A comparison of American undergraduate student attitudes to attitudes from a group of global professionals.

Question Specific	Average	Sigma	Average	Sigma	Difference	Sigma Diff
1. I would like to join an organization that emphasizes getting to know people from different countries	4.46	1.18	5.73	0.46	1.27	12.54
2. Persons with disabilities can teach me things I could not learn elsewhere	4.63	1.10	5.27	1.03	0.64	6.28
3. Getting to know someone of another race is generally an uncomfortable experience to me	1.75	0.96	2.05	1.68	0.30	2.80
4. I would like to go to dances that feature music from other countries	3.50	1.36	5.00	1.07	1.50	12.25
5. I can best understand someone after I get to know how he/she is both similar to and different from me	4.60	0.98	4.82	1.33	0.22	2.20
6. I am only at ease with people of my race	1.63	0.83	1.45	0.96	0.18	2.23
7. I often listen to music of other cultures	3.45	1.53	4.91	1.23	1.46	10.53
8. Knowing how a person differs from me greatly enhances our friendship	4.04	1.31	4.23	1.66	0.18	1.43
9. It's really hard for me to feel close to a person from another race	1.63	0.90	1.50	0.91	0.13	1.57
10. I am interested in learning about the many cultures that have existed in this world	4.48	1.30	5.45	1.30	0.97	7.99
11. In getting to know someone, I like knowing both how he/she differs from me and is similar to me	4.56	1.13	5.00	0.87	0.44	4.35
12. It is very important that a friend agrees with me on most issues	2.73	1.13	3.55	1.57	0.82	7.12
13. I attend events where I might get to know people from different racial backgrounds	3.88	1.35	5.18	0.80	1.30	10.99
14. Knowing about the different experiences of other people helps me understand my own problems better	4.27	1.33	5.41	0.50	1.14	9.99
15. I often feel irritated by persons of a different race	1.89	1.22	1.55	1.10	0.35	3.10

Table 9 A comparison of American undergraduate student attitudes to attitudes from a group of global professionals.

Conclusions and Suggested Approaches

Certainly the present analysis of the data from these surveys is at a high level and deserves, and will get, further study investigating variations and fine structure. Nevertheless this analysis suggests some constructive assessments that can help guide curriculum and anticipate issues developing team dynamics.

1) In future surveys, the MGUDS-S survey will be edited and the words "race" will be replaced with the word "culture". The work "race" was found to be insulting to German students.
2) It is important to bridge the emotional comfort gap between students early in the formation of international teams. Face to face interaction should occur early and may overcome some of the issues regarding team dynamics.
3) Curricula activities should include an awareness and involvement in events and aspects of other cultures in order to increase awareness in cross cultural diversity.

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