AC 2007-433: THE ENHANCEMENT OF THE COMPUTER SYSTEMS TECHNOLOGY CURRICULUM WITH MULTICULTURAL COMPETENCIES AND INFORMATION LITERACY

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The Enhancement of Computer Systems Technology Curriculum with Multicultural Competencies and Information Literacy

Introduction

In today's world students need to be technological and information literate to find and research information. This project is a work in-progress and seeks to help undergraduate Computer Systems Technology students become both information literate and multicultural competent. Students investigated and analyzed the history, social, economic, political, cultural, and institutions of countries throughout the world.

The main goal of this project is to help students become both technological and information literate as well as multicultural competent.

Three frameworks are being employed to guide the project (1) information literacy as proposed by the Association of Colleges and Research Libraries[1], (2) K-State's Tilford Group Multicultural Competencies Development[2], and (3) TAC/ABET Student Learning Outcome "j"[3].

The study uses a project-based learning (PBL) approach which aims at developing deep understanding and transferable knowledge. PBL is most useful with an "ill-defined" project in which multiple variables may lead to multiple solutions or points of view. PBL uses real world problems to stimulate students into identifying and researching concepts and principles they need to know in order to act upon these problems[4].

Information Literacy

According to the Association of College and Research Libraries'[1] web site the information literate student will be able to: (1) determine the nature and extent of the information needed, (2) access needed information effectively and efficiently, (3) evaluate information and its sources critically and incorporates selected information into his or her knowledge base and value system, (4) individually or as a member of a group, use information effectively to accomplish a specific purpose, and (5) understand many of the economic, legal, and social issues surrounding the use of information and accesses and use information ethically and legally.

The need for improved teaching of information literacy skills has been well-documented in the last two decades. Typical of many studies, Seamans'[5] survey of First-Year students shows that their strategies for locating information are underdeveloped. Undergraduates tend to perform research not as exploration, but to garner support for a predetermined viewpoint. The students surveyed used one keyword when given an information-retrieval task, and used no Booleans, expressing reservations about their use as an unfamiliar concept. The survey also found that students do not see libraries and library personnel as part of information seeking.
Lecki and Fullerton[6] tell us that "Evidence is rapidly mounting that students cannot select appropriate sources of information, do not understand the structure or purpose of different sources of information, and cannot critically evaluate the information they retrieve."

Because of research results and our own experience with undergraduate students, we felt it necessary to include an information literacy (or as some people in the field call it information fluency) component in our program. We knew the students would have to use information literacy skills to be able to complete their projects.

Multicultural Competencies

Another framework to support the goals of this project is provided by the Kansas State University's Tilford Group Multicultural Competencies Development, which has been defined as "the knowledge, skills and personal attributes needed to live and work in a diverse world."[2]

Following is a summary of these competencies:

1. Knowledge – Awareness and understanding needed to live and work in a diverse world.
    a. Cultural Self – The ability to understand one's ethnic identity and how it influences identity development.
    b. Diverse Ethnic Groups – Knowledge of diverse ethnic groups and their cultures.
    c. Social/Political/Economic/Historical Frameworks – Awareness of how social, political, economic and historical issues impact race and ethnic relations in the world.
    d. Changing Demographics – Understanding population dynamics related to ethnic minority and majority citizens.
    e. Diversity Implications for Career – Understanding how diversity impacts the academic discipline, career and professional development.

2. Personal Attributes – Traits needed by those who live and work in a diverse world.
    a. Flexibility – The ability to respond and adapt to new and changing situations.
    b. Respect – An appreciation for those who are different from one's self.
    c. Empathy – The ability to understand another person's culture by listening to and understanding their perspective.

3. Skills – Behaviors and performance tasks needed to live and work in a diverse world.
    a. Cross Cultural Communication – Verbal and nonverbal communication skills in interaction with those who are culturally different from one's self.
    b. Teamwork – The ability to work in culturally diverse groups toward a common goal.
    c. Listening – The intention and ability to attend to what others are saying.
    d. Conflict Resolution – The ability to resolve cultural conflicts that occur between individuals and groups.
    e. Critical Thinking – The ability to use inductive and deductive reasoning to understand diverse perspectives.
    f. Language Development – The ability to speak and write more than one language.
    g. Leadership Development – The ability to provide multicultural leadership.

TAC/ABET Learning Outcomes

Another framework that will be taken into consideration is related to the TAC/ABET (Technology Assessment Commission/Accreditation Board for Engineering and Technology) accreditation document. There are eleven student learning outcomes ranging from technical skills to personal traits to citizenship. This project will focus on the student learning outcome known simply as outcome *j*. It states that graduates will demonstrate "respect for diversity and knowledge of contemporary professional, societal and global issues" and it is aligned with the three competencies selected from the Tilford Group.

Project Details

The pilot module was incorporated into two courses in the Computer Systems Technology undergraduate program – CMST 103 Introduction to Program Design (freshman course) and CMST 420 Advanced Database Systems (senior course).

The assignment was given to students without too much detail as is usual with classroom assignments. They were not told where to start, which type of resources to use, how long (or how short) the final project should be, how it should look like. Although the authors were approached several times with the familiar question "Just tell me what you want …"

Students were instructed on basic online research especially concerning reputable online data and information. It was also suggested that students read Friedman's *The World Is Flat*[9] and three other especially selected articles to sparkle their interest as well as to place the project in some perspective[10, 11, 12].

The assessment component of the project included:
- Pre- and post-test that attempted to measure changes in attitudes toward and perceptions of workplace diversity.
- A paper in which students self-reflected on their learning experience. Students were asked to address how this learning experience helped (or did not) change attitudes and misconceptions toward diversity in general. Special attention was given to help students develop research strategies that will continue through their professional careers.
- Students made presentations about their projects to classmates.

The first set of pre- and post-test used a survey developed by the Library's faculty and was specifically designed to assess knowledge about information literacy. The instrument contained a total of seven statements including demographic questions.

The second set of pre- and post-test employed a survey instrument called Attitudes Toward and Perceptions of Workplace Diversity[7]. This instrument was reported to "offer a valid, useful assessment of diversity attitudes and perceptions." The instrument contains 20 statements that employ the following 5-point Likert-type scale:
- 1 = Disagree
- 2 = Disagree Somewhat
- 3 = Neither Agree nor Disagree
- 4 = Agree Somewhat

- 5 = Agree

Results of the pre- and post-test are presented as descriptive statistics (see Tables 1 and 2).

The students participating in the project were asked to keep a journal of their activities and to write a final reflection about their experience. These two requirements added a qualitative dimension to the data collected as well as provided some insights on personal experiences and relevant student observations about the whole learning experience. Hazzan and colleagues[8] writing about the advantages of using qualitative research in some studies, notably computer science education, noted that:

> … in many cases, CSE [computer science education] research deals with topics related to learners' mental, cultural and social processes. Such processes, by nature, are rich, consisting of many details and perspectives. Accordingly, it is reasonable to assume that if we approach these processes with a qualitative approach, which concentrates on the details that constitute them, we may deepen our understanding of such processes. (p. 412)

The research approach to the project, passages and initial analysis from the students' self-reflection are presented as well (due to space limitation, the students' presentations were not included in this paper; however, copies can be requested from the authors.)

Pre- and Post-Tests

Table 1 – Pre- and Post-Test Freshman Course

Freshman Course	Pre Test		Post Test	
	Mean	Std Dev	Mean	Std Dev
1. I believe that diversity is fair.	3.9	1.16	4.3	0.78
2. Diversity is stressful for me.	1.9	1.08	2.2	1.19
3. I feel enthusiastic about diversity.	4.0	1.04	4.2	0.83
4. Diversity is expensive for organizations.	2.8	1.11	2.8	1.34
5. Diversity leads to harmony in organizations.	3.9	0.67	3.8	1.19
6. I feel frustrated with diversity.	2.0	1.13	1.8	1.19
7. I feel hopeful about diversity.	4.2	0.94	3.8	1.19
8. I believe that diversity is worthless.	1.2	0.39	1.3	0.65
9. I support diversity efforts in organizations.	4.6	0.51	4.4	0.90
10. I withdraw from organizational/educational diversity efforts.	1.6	1.00	1.8	1.11
11. Diversity is rewarding for me.	3.9	0.83	4.0	0.95
12. I feel resentful about diversity.	1.6	0.90	2.0	1.41
13. Diversity is an asset for organizations.	4.4	1.00	4.3	0.87
14. Diversity leads me to make personal sacrifices.	2.9	1.16	2.8	1.29
15. I participate in organizational/educational diversity efforts.	3.2	1.34	3.6	1.44
16. I resist organizational/educational efforts.	2.3	1.37	1.8	1.06
17. I believe that diversity is good.	4.6	0.50	4.5	1.17
18. Diversity is unprofitable for organizations.	2.5	1.09	2.3	1.30
19. Diversity is enriching for me.	3.9	1.08	3.8	0.94
20. I believe that diversity is unjustified.	1.8	1.27	1.8	1.27

Table 2 – Pre- and Post-Test Senior Course

Senior Course	Pre Test		Post Test	
	Mean	Std Dev	Mean	Std Dev
1. I believe that diversity is fair.	4.1	0.94	4.1	1.17
2. Diversity is stressful for me.	2.0	0.89	1.9	1.14
3. I feel enthusiastic about diversity.	3.5	1.00	3.4	1.27
4. Diversity is expensive for organizations.	2.7	0.98	3.0	0.94
5. Diversity leads to harmony in organizations.	3.6	1.23	4.1	0.83
6. I feel frustrated with diversity.	2.0	0.97	2.2	1.30
7. I feel hopeful about diversity.	4.0	0.76	3.9	0.78
8. I believe that diversity is worthless.	1.6	0.94	1.5	0.72
9. I support diversity efforts in organizations.	3.7	1.03	4.1	0.86
10. I withdraw from organizational/educational diversity efforts.	2.1	1.12	1.9	1.03
11. Diversity is rewarding for me.	3.2	0.95	3.5	1.01
12. I feel resentful about diversity.	1.6	0.83	1.4	0.61
13. Diversity is an asset for organizations.	3.9	1.04	4.2	0.66
14. Diversity leads me to make personal sacrifices.	2.5	1.23	2.5	1.23
15. I participate in organizational/educational diversity efforts.	3.2	0.95	3.5	0.80
16. I resist organizational/educational efforts.	1.6	0.75	1.7	0.85
17. I believe that diversity is good.	4.1	1.10	4.1	0.78
18. Diversity is unprofitable for organizations.	2.0	1.17	2.1	0.93
19. Diversity is enriching for me.	3.5	1.15	3.7	1.10
20. I believe that diversity is unjustified.	1.8	0.89	2.0	0.87

Comments from Reflection Papers

Following are some excerpts taken directly from the students' self-reflection on their learning experience. These self-reflections are being currently coded for further analysis using qualitative research methodology. The authors hope that the self-reflections will help give more meaning to

the statistical analysis of scores produced by the pre- and post-test instruments and help us "deepen our understanding of such processes"[8] [attitudes toward a learning experience].

Excerpt #1
My group also seemed to be quite surprised at the things we discovered about the country that we studied. They also were rather ethnocentric, and the group assumed that the way they looked at the world was the "right" way to do so. Because another culture and religion is so different than your own does not make it wrong, and one would be wise to learn from it.

Excerpt #2
We are but small players, tiny pieces in a puzzle we cannot hope to comprehend ourselves, and we must learn to act and fit with each other in a constructive manner.

Excerpt #3
While not having a full sense of fulfillment as this project comes to a close I also have a hunger to learn more on my own, which may be somewhat a fulfillment of the project's goal if it is to stimulate a hunger for learning.

Conclusions

Following are some conclusions based on the authors' observations and students' reactions found in their reflection papers:

1. The project should have been assigned earlier in the semester to give students more time to "think through" the research process. This point was made in several reflection papers as well as during formal project presentation.

2. Students enjoyed the learning experience and initial statistical analysis of pre- and posttests seems to indicate a positive change in attitude towards the importance of diversity in the workplace.

3. Students seem to have a better understanding of information literacy and its importance in their educational development and lifelong learning.

4. Initial analysis of reflection papers seems to indicate a positive attitude change towards an "appreciation" of diversity in the workplace rather than "tolerance." Students seem to appreciate diversity as an asset to the organization.

5. Students have commented that they now see diversity as differences of ideas, differences of approaches to problem solving, the ability to "see" and understand problems from a different angle. It was rewarding to read comments that race is nothing but a small portion of the diversity "big picture."

The authors were very pleased with the project's outcome. However, several changes will be made for the Spring 2007 course offering:

1. The project will be carried out with the senior class only. This is due to the fact that students at the senior level have more technical knowledge and overall academic coursework to appreciate the topic of diversity and its impact on their professional lives.

2. The project will be part of the coursework, it will be noted in the course syllabus, and will be assigned much earlier in the semester (perhaps around week 5).

3. The project will be graded as a regular lab project not as an extra-credit assignment.

4. Rather than choosing a country; students will be assigned a technical project – develop a database, develop a software package, etc. – for a business in a country to be decided by the instructors.

5. Students will select the best project based on contents, research level, written report, and presentation. The best project will be submitted as a student research paper to the ASEE Midwest Section Meeting.

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