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International Agriculture Case Studies for Enhancement of Undergraduate Competency in Cultural Adaptability

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Abstract
With the advent of globalization, employers of post-secondary agriculture graduates require that those graduates have cultural adaptability (CA) competency. However, in spite of the wealth of international resources available to students at land-grant universities, many students do not gain CA competency before they graduate. Therefore, a need exists to integrate international content into undergraduate agricultural curricula that will increase the CA competency of graduates. The overall goal of this project is to develop an educational model for enhancing the cultural adaptability competence of agriculture undergraduates through the use of case studies based on actual international agriculture problems, using experiences from faculty involved in international projects. In this phase of the project, we developed three prototype case studies for implementation into on-campus courses, each with a different implementation strategy.

Keywords
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Introduction

With the advent of globalization, employers of post-secondary agriculture graduates require that those graduates have cultural adaptability (CA) competency. However, in spite of the wealth of international resources available to students at land-grant universities, many students do not gain CA competency before they graduate. Therefore, a need exists to integrate international content into undergraduate agricultural curricula that will increase the CA competency of graduates.

Over the past 100 years, the Department of Agricultural and Biosystems Engineering (ABE) at Iowa State University (ISU), has been a leader in providing engineering solutions to agricultural problems in the United States and around the world. The department's original mission was to mechanize agriculture. That mission has evolved to encompass a global view of the entire food production system--the wise management of natural resources in the production, processing, storage, handling, and use of food fiber and other biological products through application of engineering, technology, and science. In ABE we have three undergraduate degree granting programs: 1) Agricultural Engineering (AE), 2) Agricultural Systems Technology (AST), and 3) Industrial Technology (I Tec) with a total of roughly 530 undergraduate students and 100 graduate students. Of the current twenty-seven ABE faculty, all have been actively involved in some level of international activity and travel experience (education or research related). One would assume that with this high percentage of international experience that the faculty could and would clearly convey an understanding of international dimensions of agricultural, engineering, technology, and related sciences to the students in their classes and extra curricular programs. But this is not typically the case.

To produce graduates who can be active members in a global food production system, ABE has developed a competency-based learning approach which includes a constituent-created, constituent-validated method for measuring learning outcomes for graduates (Mickelson et al., 2002). This approach was developed for the College of Engineering (COE) at ISU in 2001 and has continued to be used through the present time. ABE has been a leader in bringing this highly regarded approach to agricultural degree programs (Brumm et al., 2006a; 2006b). The COE requires assessment of fifteen workplace competencies for internship or cooperative education students each term that they are out in the workplace. Over the past five years, these fifteen competencies are evaluated for each student by the student's supervisor. The students also self-assess their performance in the workplace relative to these competencies. Figure 1 shows areas of workplace competence rankings for our ABE student completing their co-op/intern experiences from fall semester of 2001 through spring semester of 2005. The supervisor's assessment is considered a direct assessment, since they are able to assess the student's work behavior in the workplace setting. The supervisor ranking of cultural adaptability (CA) places it in the lowest five of the fourteen competencies. Students rank themselves much higher in cultural adaptability than do the supervisors, but this is considered an indirect assessment, or the opinion of the student's performance based on their own experiences.

CA is defined as "*Being open to and making changes to accommodate the differences found in other cultures in order to interact effectively with individuals and groups from a different cultural background* (DDI, 2005)." Key actions that demonstrate CA include "exhibiting sensitivity", "demonstrating inclusive behavior", "adapting behavior to other cultures" and "adapting products and process to cultural concerns" Within the key action rankings, ABE students show strength in sensitivity and inclusion behavior; however, the same students score low in their ability to adapt to another culture, indicating that students are willing (since they are sensitive and inclusive), but do not have sufficient understanding or opportunity to interact with other cultures to acquire

adaptive skills. This is especially troubling since there is a wealth of international experience and cultural opportunities in the department, colleges, and university that, if mined correctly, would allow for growth in this problem area.

There are many international opportunities of which undergraduates can take advantage. While the number of students studying abroad has increased dramatically in the last ten years at Iowa State, the total number going abroad still represents a very small percentage of undergraduate students. Roughly 10% of students in the College of Agriculture and roughly 12% of eligible students in the College of Engineering take advantage of international opportunities on any given year. While the challenge continues to increase these numbers, it is crucial to develop parallel opportunities to internationalize the education of the 88%+ students in those colleges who remain on campus each year. However, there are currently no formalized educational methodologies for transferring knowledge and experiences gained through existing and future international collaborations among faculty and graduate students to the undergraduate students.

Thus, the overall goal of this effort is to is to develop an educational model for enhancing the cultural adaptability (CA) competence of agriculture undergraduates. The specific objective of this phase of the project was to build and evaluate a model for developing case studies that agricultural engineering and technology students can use to improve their CA awareness and skills, and to use this model to develop several case studies for integration into the classroom. While the case study approach has frequently been used as an active learning strategy, there are few examples of technical cross-cultural case studies for scientists and engineers. Several cross-cultural case study projects exist in the medical care field, but these examples do not involve challenging the students to reflect on how cultural and international differences may affect the design process and the efficacy of technical solutions.

Implementation

Three modes of case study utilization were employed. From least complex to most complex, they are: active learning exercises based on a case study, key assignments based on a case study, and full case simulation. For each of these techniques, one example was developed. For the first two of these techniques, the examples were piloted in on-campus courses during the 2006-07 academic year.

Case-based Active Learning

This is probably the most traditional application of case studies, but is one that has value in courses and requires the least amount of effort on the part of the instructor to use. As such, this might be an entry point for instructors who want to use case studies, but are reluctant or are constrained by time. With this method, a case study is presented as part of a classroom discussion. After the case is presented, the students engage in an active learning exercise such as “turn-to-your-partner” or “a one minute paper.” After the students work individually or in pairs, they then report out to the class and be involved in a class discussion guided by the instructor.

In this phase of the project, we developed one such case study on water quality remediation strategies for the Republic of Georgia, with assistance from an ABE PhD student native to that country. This case was developed for and implemented in TSM 424: Agricultural Impacts on Water Quality, a technology course which includes an introduction to major categories of water quality impairment, with a particular emphasis on non-point source pollution. A slide show was presented describing the history and geography of the country, current economic, social, and political conditions, as well as background information on current state of environmental

conditions and regulation in the country. The case was then presented, in which introductory information about a particular watershed was provided. This document ended with the following charge:

> *"One of the main reasons causing the violation of the standards is the surface water supplies are generally unprotected. People from nearby villages discharge their wastewater directly into the river system, with almost no treatment. Due to over-filled old landfill sites and a particularly disintegrated system of waste management, several uncontrolled and illegal landfill sites have emerged that are located near the water body. This is further exacerbated by agricultural practices in the area, particularly by over-application of agricultural animal manure, which is the main source of pollution for the river. Another concern is livestock grazing in high numbers, including near to the river and its tributaries.*
>
> *Your boss has received some funding from the Millennium Challenge program (a US State Department initiative) to develop strategies for water quality protection in Georgia. You have been asked to brainstorm some preliminary ideas for the Aragvi basin in particular.*
>
> - *Given the scope of these difficulties and serious budget constraints in the country, come up with one or two recommendations for addressing these local water quality standards.*
> - *The recommendation should be both feasible and sustainable, and something that could make a real difference in the near to mid term. Consider what steps would be necessary to implement your recommendation."*

The students were divided into small discussion groups, and given 10-15 minutes to develop potential recommendations. Each group then presented their analysis to the class and the instructor facilitated discussion, with the Georgian graduate student on hand to answer specific questions about the situation in the country.

We did not solicit feedback from the students on this activity. However, both the instructor and the graduate student completed a reflection on how the activity went. Both felt that the ensuing discussion was of high quality. They noted an appropriate degree of constructive cross-criticizing of various groups' ideas, so that when one group raised a potential strategy that another felt was not in keeping with the constraints or situation we had discussed, they would point this out. In the future, this activity will culminate with the students also writing individual reflections on the activity.

Case-based Key Assignments

Key assignments in courses can use case studies by requiring the students to access a case study, interacting with the case to understand its contents and then completing an assignment in which they apply the knowledge which they are learning in the course to the case. Over the long term, it will be important to have key international case study assignments in each of our core required courses, vertically integrated from the freshman to the senior year. We would strongly encourage the students to place one or more examples of these key assignments in their ePortfolio system, which we use for assessment of curricular core competencies, with an appropriate reflection piece. However, for this initial phase of the ongoing project, we developed a single key assignment for use in one class.

An assignment to develop constraints and a schedule for a vegetable Irrigation system in Puerto Rico was developed for and used in TSM 324: Soil and Water Conservation Management. The

development of this assignment was done primarily by a PhD student who had spent over ten years as an NRCS field agent in Puerto Rico. In class, the situation and assignment were explained to the students, and an assignment sheet provided. The PhD student led a short discussion of the problem, including highlighting key differences with irrigation situations elsewhere in the US with which students were more familiar – the primary difference is limited and intermittent electricity for pumping in Puerto Rico. Students were given one week to work the problem and write a technical memo describing their solution. The memo needed to incorporate technical content learned in class with the additional constraints explained in the assignment,

The assignment read,

> *Maria Rosado would like your help in designing an irrigation system for a half-acre of vegetables on her property in Corozal, Puerto Rico. You have no time for this but you agree to provide some basic design criteria.*
>
> *Water can only be pumped from the adjacent river during weekends and must be stored in a tank for irrigation by gravity. Ms. Rosado can only operate the irrigation system on Tuesdays, Thursdays and/or weekends. The vegetable crops will be irrigated with a drip system which is nearly 100% efficient.*
>
> *Given/known data:*
>
> > *Evapotranspiration rate (ET) in PR for vegetables = 0.25 in/day*
> >
> > *Soil Texture is clay loam*
>
> *Task: Answer the following questions for Ms. Rosado.*
>
> > *What are the irrigation requirements for this plot?*
> >
> > *What schedule would you recommend for irrigating?*
> >
> > *What dimensions rectangular tank will be needed?*
> >
> > *What capacity (in gallons per minute) should the pump have to fill the tank in 5 hours?*

No feedback was solicited from the students in regard to this specific assignment. However, the instructor and the graduate student did complete post-activity reflections. Generally, there was not a clear indication that the students really "got" the concept of adapting their solution to unfamiliar constraints – despite the discussion prior to the assignment, most of the students did not understand why there were any limitations on the pumping and irrigating schedule. This assignment is currently going through redevelopment to improve the student learning. We are also developing a similar but more design-oriented problem for use in AE 431/531 (the engineering counterpart to TSM 324).

Case Simulation

We will deliver CA case studies electronically through case simulations used in courses that teach disciplinary content in the context of the case. These case simulations will follow the case-study delivery model we have previously developed for a technical writing course which is part of the ABE Learning Community and have used for seven semesters. This educational model is a Maddux Type II incarnation of the case-study method (Fisher et al., 2003), one that takes advantage of internet technologies to create a learning environment that transcends traditional case narratives. Our case simulation method contributes two additional components to the case-study approach. First, we provide a learning environment in which students must

actively construct knowledge essential for the development of the organization evoked in the case. In this regard, our approach mirrors traditional open-ended case studies, yet through the use of technology, we are able to provide a learning environment (the case) in which students draw from and contribute to an interactive resource of artifacts, so as to become actively involved in the day-to-day practices of a group. Furthermore, students must—based on their understanding of the artifacts—identify, communicate, and justify a course of action. In this sense, students move beyond analyzing and responding to a traditionally narrated, historical case and instead become immersed in the process of "making sense" and communicating in an effort to render the organization for a number of audiences. Second, the day-to-day interactivity afforded by the electronic case serves as a learning platform by which students become progressively engaged in more complex disciplinary and communicative activities. Because this approach is computer mediated, the case affords the opportunity for students to more readily interact with a greater volume and wider range of information than can be transmitted through traditional hard-copy case studies.

We are in the process of developing a case following this model, based on designing a coffee drying for use in rural Brazil. This development was initially begun for use of the case in AE 469/569: Grain Processing and Handling, in which one of the core topics discussed is grain drying. However, in the process of developing the case, we concluded that various versions of the same problem could be used in other classes instead, such as one of our more introductory classes earlier in the curriculum in which students are introduced to the design process.

Development of this case was done primarily by senior undergraduate student who had done a semester-long study abroad in Brazil. During a portion of the student's stay in the country, university faculty were on strike from teaching, so in that interim the student shadowed a Brazilian professor doing field and extension work in rural areas. To date, the materials developed for this case include a 40-minute narrated slide show (stored as picture-in-picture Flash-driven streaming video) explaining the process and constraints of coffee drying in Brazil; streaming video of an "investor" (actually a Brazilian graduate student) explaining that his company would like to hire the students to do a preliminary drying system design; an assignment sheet and problem statement detailing the scenario; supplemental information on relative cost and quality impact of various components of the drying process; and a list of additional sources of coffee-related information to get the students started in their understanding of the system.

The narrated slide show, or a segment of it, can be used as a basis for short active-learning exercise, or the full set of resources can be used as part of a case simulation, which is anticipated to be a multi-week activity.

Conclusion

In order to provide opportunities for on-campus students to develop and/or demonstrate competency in cultural adaptability, we have begun to create a suite of case studies that include a significant cross-cultural component. Three different methods of case study development and implementation are being used, and two case studies have been successfully piloted in this initial phase of the project. Future work will focus on continued development and improvement of these ad other cases, and development and implementation of appropriate assessment strategies.

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References

Brumm, T.J., L.F. Hanneman and S.K. Mickelson, 2006a. Assessing and Developing Program Outcomes Through Workplace Competencies. *Int. J. Engng Ed.* 22(1): 123-129.

Brumm, T.J., S.K. Mickelson, B.L. Steward and A.L. Kaleita, 2006b. Competency-based outcomes assessment for agricultural engineering programs. *Int. J. Engng Ed.* 22(6): 1163-1172.

Development Dimensions International, Inc. Online Performance And Learning (OPAL™), http://www.ddiworld.com/leadership/opal.asp, accessed October 27, 2005.

Fisher, D., T. Bowers, A. Ellertson, T.J. Brumm, and S.K. Mickelson. 2003. As the case may be: The potential of electronic cases for interdisciplinary communication instruction. *IEEE Trans. on Prof. Comm.*. 46(4): 313-319.

Mickelson, S.K., L.F. Hanneman and T.J. Brumm. 2002. Validation of Workplace Competencies Sufficient to Measure ABET Outcomes. *Proceedings of the Annual meeting of the American Society for Engineering Education*, American Society for Engineering Education, Montreal, Quebec, Canada, June, 2002.