

# Developing Software Education Across International and Cultural Boundaries: A Case Study

Charles H. Tidwell, Jr. and James Wolfer

**Abstract** — Computer education now transcends traditional boundaries. Software is now marketed on a global basis. Developers increasingly work in multicultural teams. Although our institution has exceptional diversity, international students often view this as “foreign.” Cultural awareness should be intrinsic to the educational process rather than a learned, work-place experience. To enrich the awareness of both Software Engineering faculty and students, we have expanded our Software Engineering program into Asia.

Besides describing the program, academic issues such as delivery modes, articulation, and cross-cultural relationships are addressed. Administrative issues such as admission, documentation, recruitment, support structures, and student assessment are presented. Pragmatic challenges such as finances and logistics are reviewed. Social and personal considerations such as separation from family and communication channels are covered. Finally, we address the sustainability of future programs.

**Index Terms** — Software engineering education, international extension programs, cross-cultural issues.

## I. BACKGROUND AND RATIONALE

During the past decade, the impact of computing has transcended traditional geographic, ethnic, and political boundaries. Software, once developed for local consumption, is now marketed on a global basis. For instance, a recent article in *Electronic Engineering Times* describes a Taiwanese software company that employs 200 engineers in six countries programming using a combination of “C++ and broken English” [1]. Thus, software developers, who increasingly work in multicultural teams or in partnerships across international boundaries, often find it essential to be sensitive to cultural factors such as language, educational systems, religious preferences, national, ethnic and racial stereotypes, and even mundane issues such as food preferences and climate. Because of these factors, the Software Engineering program at Andrews University, a private university in the American mid-west, has been deliberately developed to enhance cross-cultural perspectives. Not only does the university actively recruit international students, it also delivers programs around the world in Asia, Africa, Europe, and Central America.

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Since our university has an exceptionally high level of cultural diversity as noted in annual rankings of U.S. colleges

and universities by *U.S. News & World Report* [2], both students and faculty benefit from a wide spectrum of cultural viewpoints.

Unfortunately, these perspectives are generally viewed by many international students as a part of our “foreign” environment rather than as part of a system providing a competitive advantage. Since we perceive that cultural awareness should be a part of the educational process rather than a learned work-place experience, and because of a perceived need to enrich the cultural awareness of its faculty, nearly ten years ago the Software Engineering faculty expanded its program into Asia, primarily in Singapore.

We began to offer the Master of Science in Software Engineering in Singapore in 1992 followed by Taiwan from 1995-1997. There are several reasons why the Software Engineering faculty have become involved in an internationally-delivered extension program. In addition to strengthening the teamwork concept which is increasingly integral to software development, the program administrators and faculty have been concerned about issues such as internationalization, income generation, faculty development, the international presence of the university, and the development of cross-cultural skills. Specifically, we perceive the following benefits:

1. Internationalization: Such programs broaden both faculty and student perceptions of international software engineering issues. Software development and services are understood as global rather than local matters.
2. Income generation: These programs generate income directly to our university. They also directly impact faculty income since at the present time faculty who teach in these programs are paid on the basis of individual contracts for each course taught.
3. Faculty development: Involvement in such programs provides research and enrichment opportunities. Several faculty have developed research presentations as a result of their extension experience. Faculty also have obtained the enrichment that comes from international travel and exposure to other cultures.
4. International Presence: Such programs develop a fuller world-wide presence for Andrews University.
5. Interculturalization: Because software development and software education are as much relationship-oriented as they are mastery of technology, face-to-face distance learning rather than teaching through a correspondence mode promotes a deeper level of intercultural awareness both professionally and personally. Faculty and students alike develop skills which assist with working in a

diverse environment. Such an intercultural process provides a competitive advantage for the program and for individual students.

## II. PROGRAM DESCRIPTION AND DELIVERY

The Masters of Science in Software Engineering offered abroad is identical to the on-campus program in terms of admission requirements, curriculum, and faculty. Admission to the program requires the prior completion of a baccalaureate degree in computing. Students entering with a baccalaureate degree from another discipline must successfully complete a suite of courses to gain proficiencies. These foundation or prerequisite requirements involve courses in mathematics including calculus, discrete math, and statistics, courses in two programming languages including C / C++, as well as courses in computer organization and assembler. The curriculum for the graduate program requires completion of a standard grouping of 12 quarter-system courses including advanced software engineering, formal methods, network and computer architecture, two group projects and two individual projects, and electives such as objected-oriented programming, network authoring, and artificial intelligence.

These courses are offered over a two-year period. In contrast with some other modes of distance education, full-time faculty travel to the extension site approximately four times a year, usually during term breaks in March, December, June, and August. Each course includes two weeks of intensive lectures (36 contact hours) supplemented by pre- and post-lecture exercises. These include readings and problems assigned two to four weeks before the intensive lectures and post-lecture assignments such as research projects and examinations scheduled four to six weeks after the intensive lecture sessions. Typically, a full course lasts eight to ten weeks, although the lecture period only takes twelve to fourteen days.

A significant feature of the program is a requirement that students travel to the U.S. campus for two intensive courses in the middle of the program. The benefits of the on-campus study include: a clear identification with the home campus and faculty, a development of group cohesiveness which improves the teamwork components of the program, and a greater opportunity to build cross-cultural skills.

## III. ACADEMIC ISSUES

Offering an extension program has required faculty and administrators to address a number of cross-cultural issues. While the basic curriculum has not required any significant adjustments, the admission and delivery systems have required modification due to cultural and logistic factors. Admission protocol when dealing with applicants from a diverse educational background requires greater attention to articulation with other educational systems. In Singapore, for instance, there has been a need to understand the systemic differences between students educated in British educational systems which usually offer a three-year baccalaureate degree

compared to the four-year degree typically found in North America. Related to this issue of degree comparability is the need to have clear academic equivalents. Consideration has to be given to the duration and comprehensive specialization of European, Asian, and South American degrees and to the differences in grading systems. Simply put, both grading and curriculum systems differ. However, admission offices typically follow a fairly rigid application assessment. Thus, acceptances by the department have occasionally needed to be on an exception basis which takes into account such systemic differences.

A more significant cultural factor has been the intrinsic knowledge base differences. Asian students are typically rote and year-end exam oriented in comparison to the homework / concept synthesis models followed by most American students. Faculty have needed to adjust their teaching styles, particularly when in Asia and especially in the first courses at the beginning of a program, to compensate for the rote system of many of their students. For instance, as part of their initial course overview, particularly at the beginning of the program, faculty have needed to explain carefully the differences between educational systems and point out their expectations. For example, the weight given by an American teacher to homework and class assignments is often higher than the weight given to a final examination.

Faculty have also found it important to adjust to the collectivism and power distance dimensions noted by Geert Hofstede in his seminal study [3]. For example, students from a generally collectivistic society such as Singapore adjust well to the teamwork mode that is a significant part of the software engineering program. However, the differences in the power distance dimension do impact faculty – student relations. Typically, Asian students do not question or discuss issues in class with the same degree of informality and individuality typically expected by an American teacher. In addition, they tend to treat teachers with a greater degree of deference than is often expected by highly informal American software engineering academics, particularly at the graduate level. It should be noted, however, that Singaporean students do acculturate fairly quickly and accept the individualism and low-power distance modes which generally characterize the expectations of their American teachers.

A final academic issue has been the tensions that occur in dealing with local commercial providers who are more profit-oriented than academic in nature. For example, the following issues have not always been clearly addressed or even understood by the service provider: the nature of appropriate recruitment (particularly the need for transparency regarding admission requirements, costs, and facilities), the need to make timely and adequate provision for students to remove undergraduate deficiencies, the need to provide adequate academic documentation of prior education, and the provision of adequate teaching and support facilities. Since many of these issues involve local support staff, the relatively high turnover of such staff has made it difficult to maintain clear communication on these issues.

#### IV. ADMINISTRATIVE AND PRAGMATIC ISSUES

While faculty are responsible for course delivery, administrative support is provided by a university extension programs director and a departmental program coordinator working in conjunction with the graduate admissions office. These program administrators in particular have needed to become cognizant of differing educational standards. What is understood as an above average grade in Singapore may be evaluated as an average grade by American admission officers. A greater flexibility on document acquisition is also needed. Documents, such as official transcripts which are normally expected in advance of admission, may take several months to be delivered from international locations. Yet applicants, who are typically working professionals, expect immediate, if conditional, entrance into the program, especially when an insistence on complete documentation prior to admission would result in a one-year delay. University support, which is geared to the on-campus program, is stretched by the particular needs of off-campus students. Library and computer access were difficult initially, although increasing web access to academic databases has begun to make substantial improvement to student access of information. Finally, teachers face some challenges in student assessment. Community-oriented students from Asia may submit identical homework assignments or practice group-based decision making when individualism-oriented faculty have different expectations.

Pragmatic challenges include establishing a financial base that generates income for the department while not exceeding the local market rate. Although payment has been in US dollars, changes in international exchange rates are a factor since they impact delivery expense, particularly housing and travel for faculty. The most significant pragmatic challenge is maintaining adequate levels of communication. When the program first began, most communication with students was by mail or fax or through the local service provider. In the recent past, the increasing use of Internet for e-mail and web access has profoundly improved direct communication between teachers and students. Not only are course materials and information available on web pages, but teachers are now using WebCT and other distance learning technologies to enhance the extension experience.

#### V. SOCIAL AND PERSONAL CONSIDERATIONS

One of the most significant cross-cultural issues is the potential for culture shock faced by both faculty and students during their involvement in the program. Even though the university has a strong intercultural component to its on-campus program, teachers face a majority of culturally-different students when delivering the extension courses. While this is not by itself a major cultural problem, its impact is compounded by the stress of jet lag, absence from family members, changes in diet, changes in climate, and living in a different cultural environment even for a short time. Because the situation is not a tourist but a working environment, cultural differences become more important.

As previously noted by the authors, students face similar challenges [4]. Even when they are from a multicultural society such as Singapore [5], students may be participating in a significant multicultural encounter for the first time. They not only deal with a teacher from another culture but also must cope with diverse classmates. This cultural challenge is intensified when students travel to the Andrews University campus for the 16-day intensive program and encounter the same changes in diet, climate, and family isolation that their instructors have dealt with earlier. A simple example of these cultural challenges is the changes in diet. Students accustomed to a rice-based diet may find some difficulty in facing nearly three weeks of bread and potato-based meals in a college canteen. Probably the greatest cultural challenge is in communication. As Hofstede [3] and Hall [6] have noted, differences in communication style are profound cultural indicators. American faculty and students tend to be primarily "action" or task-oriented. Asians tend to be "being" or relationship-oriented.

#### VI. SUSTAINABILITY

A major question, which served as an impetus to this case study, is the sustainability of such extension programs. After nearly a decade of experience in offering this program, continued recruitment is uncertain. There have been several years of fairly high enrollments but recent years have seen a decline. Not only is there increased local competition, but many corporations increasingly are providing their own in-service training as seen in the recent development of internal corporate universities. Sustainability is not only a student enrollment issue but also one of faculty endurance. Even though no individual faculty member travels abroad more than twice a year (and usually only once a year), a decade of involvement by an annual teaching experience in an intensive mode can be wearing.

#### VII. PROS AND CONS

In assessing the success of the extension program over the past eight years, we have noted problems in the following areas: an over-extension of faculty, difficult dealings with the site agent, maintaining standards, and increasing competition.

- Over-extension. There continues to be the potential to over-extend the faculty. Since the overseas teaching occurs during breaks between quarters, there is less time for course preparation prior to the start of winter and spring terms — if a faculty member has just spent two weeks teaching in an extension course. In addition, there are some additions to the workload during the term following a extension course as the teacher corrects exams and evaluates projects or papers from the extension course which typically arrive several weeks later.
- Site Agent. Difficulties arise in dealings with the site agent and site personnel on a regular basis. There has been too rapid a turnover of assistants who do the

groundwork. This has meant an on-going difficulty in maintaining continuity of information and consistency of approaches.

- Admission standards. There has been difficulty in maintaining admission standards due to delays in receipt of student documents (transcripts in particular) and differences in standards (three-year versus four-year degree and grading standards). In particular, there is a continual pressure from both students and recruitment personnel who wish to evade standard admission requirements such as minimum TOEFL scores. This is compounded by competition from other universities with less stringent standards.
- Competition. Singapore continues to be a highly competitive and, at times, saturated market. A number of higher-education institutions, particularly from Australia and the United Kingdom, have been aggressively marketing their programs.
- Despite these problems, there are a number of positive factors to consider including: quality of students, competitive advantage gained from offering an identical program on an extension basis, and effective internationalization.
- Quality of students. A strength of the program is an enrollment made up primarily of highly motivated, adult students — often significantly placed in businesses, government, and industry in their local countries. Such students bring a broader expertise to the classroom than is often found with on-campus students just out of a bachelor's program. This has been enriching for faculty as they teach in the off-campus sites and also for on-campus students (the summer on-campus courses generally include on- and off-campus students). In addition, extension student projects are often based on real-life problems or situations and thus have an immediacy that is more effective than projects proposed and developed by students in the on-campus program.
- Identical on- and off-campus programs. Having an extension program which is essentially identical to the on-campus program provides a significant competitive advantage. Extension students, particularly after they have come to campus, recognize that they have an authentic degree. They also identify with a specific school and with specific faculty, not with faceless names and places sometimes found in other distance learning modes.

- Internationalization. Finally, an important strength has been the positive effect of developing international awareness among both faculty and extension students. As seen from an informal comparison of on- and off-campus student projects, students with cross-cultural experience appear to have a more mature approach to software development. There has also been, to a lesser degree, an impact on the on-campus students as a result of interactions with the extension students during their trip to the campus.

## VIII. CONCLUSION

Is offering extension programs across international and cultural boundaries worthwhile? The answer is a qualified yes. Andrews University has developed a culturally-aware faculty, an awareness which has been significantly enhanced by the extension program experience. Students have become much more teamwork oriented, particularly with the on-campus experience which fosters group identity from a multicultural viewpoint. The long-term prognosis, however, still raises some questions. But, it should be noted that even if the market in one locale dries up due to oversupply of software engineers or to increased competition, there are always other opportunities. If not Singapore, then perhaps Malaysia, Indonesia, India, or China? Or perhaps Central or South America. Culturally-aware software engineers who can work as part of a diverse team is a continuing need in the global industry.

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