Evaluating the Impact of Training on Increasing Cross Culture Competency

Dr. Joan B Schuman, Missouri University of Science and Technology

Dr. Joan Schuman is an Associate Teaching Professor in the Engineering Management and Systems Engineering Department at Missouri S&T. She earned her Bachelor of Science degree in Mechanical Engineering from University of Arkansas and completed her Ph.D. in Polymer Science and Engineering from the University of Southern Mississippi. Schuman is a Project Management Professional (PMP) certified through the Project Management Institute. She worked for several years in the aerospace industry with the Boeing Company initially as a design engineer and then later in systems engineering. At Missouri S&T, she teaches a variety of courses emphasizing Project Management and Financial Management for both undergraduate and graduate level courses. Her research interests focus on engineering education with a special interest in Service Learning and project management. Schuman is also the Departmental Experiential Learning Coordinator. She has developed her undergraduate project management class into a Service Learning class where the students work with area communities on real projects that benefit both the communities and students.

Evaluating the Impact of Training on Increasing Cross-Culture Competency

Introduction:

Technological, political and economic changes worldwide have driven an increase in globalization [1] and many industries that operate globally need to hire engineers that will be successful in that arena. Assigning the most technically competent engineer to a project without considering their global competency can be very costly for organizations. If these engineers fail, wasted travel and living expenses, lost contracts, and personal costs could be significant [2]. Therefore, many employers state that cross-cultural competency is important for career develop and actively recruit that skill set [3].

For some time now, industry and academia have tried to understand what attributes in addition to their technical skills are necessary for engineers to be successful on global projects. Several researchers and accrediting agencies have sought to establish a list of those skills [1],[4],[5],[6],[7]. Parkinson proposed thirteen dimensions or attributes needed global competence, but also wanted to explore which of those skills educators and industry experts dimmed most important. Based on surveys sent to attendees of the NSF Summit on the Globalization held in 2008, he compiled a list of the top five attributes. Fifteen individuals from 11 universities, 14 individuals representing 12 companies, and 2 respondents from government or ASEE completed the survey; results are shown below. Although, no agreed to list has been established, the dimensions tend to include attributes similar to the list compiled by Parkinson.

1. Can appreciate other cultures.
2. Are proficient working in or directing a team of ethnic and cultural diversity.
3. Are able to communicate across cultures.
4. Have had a chance to practice engineering in a global context, whether through an international internship, a service learning opportunity, a virtual global engineering project or some other form of experience.
5. Can effectively deal with ethical issues arising from cultural or national differences.

While many Multinational Corporations (MNCs) provide training for engineers working globally, some have argued that academia should also be equipping students with these skills [8]. If students were trained during their time at university, they would enter the workforce better prepared. The questions then become, what is the best way to prepare engineering students in the needed attributes and how would those competencies be measured. We, as educators, can train students in a classroom setting or provide them opportunities to experience real projects that exposed them to different cultures.

Opportunities for engineering students to immerse themselves into other cultures during their college years typically come from study abroad programs or programs such as Engineers Without Borders (EWB). Both can be good experiences for students but are not without challenges. The percentage of students participating relative to the total engineering student body is typically small and this population is self-selecting for their interested in global experiences. Both options can be costly, but EWB programs usually offer shorter timelines.

Longer study abroad programs also result in opportunity costs of lost income for students from internships or coops and extend graduation time.

Research on whether these programs actually increase cultural competency are mixed. Paterson et.al, found no significant changes in cultural competency as measured using the Intercultural Development Inventory (IDI) for engineering students who participated in community engagement programs [9]. These programs varied in length from 2 weeks of fieldwork abroad to a graduate program with 2 years of field research. Goldfinch and coworkers evaluated how students rated their own intercultural competence and found a minimal shift in their view regardless of their educational experience [10]. Few studies exist evaluating the effectiveness of study abroad programs to increase cultural competency, but some showed positive results. In a qualitative study, Maharaja [11] found through evaluating personal essays that student's competency increased. Jesiek [12] found that the immersive research experience abroad significantly enhanced the cross-cultural competence of participating students.

Additional training of engineering students could be difficult with the pressures to reduce the already full curriculum in order to improve the four-year graduation rate. In fact, Parkinson reasoned that universities should focus their efforts on the most important skills because there are already so many constraints on engineering curriculum [1]. Gudykunst and Hammer [13] categorized cross-cultural training based on content and method as shown in Figure 1. They proposed four different types of training. Content was grouped as specific or generalized for the cultural training. The culturally specific training focused on one country culture where the generalized training focused on areas where differences could be applied to any culture. Intellectual vs experiential training distinguished between the methods of training. Intellectual training examples include classroom lectures describing the differences. Experiential training includes scenarios or cases in which students are posed with situations to which effective solutions must be found. Matching each of the two categories results in four possible training types.

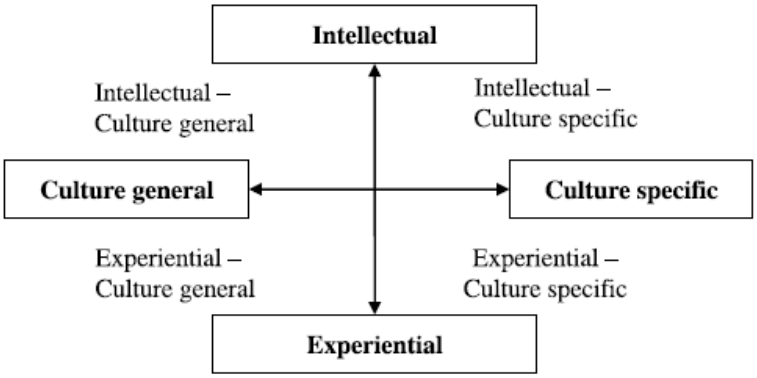

Figure 1: Cross-Cultural Training Categories

Few researchers have actually studied the quality of the training. However, J.F. Puck et al. [14] studied the effects of pre-departure cultural training on expatriates from 20 different German MNCs on their work place adjustment. They evaluated the use of pre-departure training, effects

of length of that training, and the effects of using various levels of content and methods on expatriate adjustment. In this study, international adjustment was measured using a 7-point Likert scale. Their study showed no evidence that the pre-departure training was effective in improving the expatriate adjustment. In one quantitative study, Krishnan and coworkers used the IDI survey to measure intercultural competency. In this study, a mixture of classroom training, intensive lab activities and a two week program of activities in Zambia were used. Their results were positive (excluding one outlier) showing that the training improved the results [15].

The question that this study hopes to clarify is if cultural competency of engineering students can be improved by classroom training alone. It is important to understand if the addition of a course to the curriculum can be used for those students who are unable or unwilling to participate in a study abroad or EWB type program. This study was conducted with graduate students in the Engineering Management and Systems Engineering Department in a Global Project Management course. I trained and tested cultural competency in two cohorts of students. One group consisted of both campus students along with distance students who attended class via web conferencing. The second group consisted of U.S. Army Captains who had completed a Captain's Career Course at Fort Leonard Wood Army Training Center and continued through our university to complete their Master's degree. The Army Captains have a very strong culture as part of their career training and each incoming group had been studying together for over one year's time resulting in very cohesive groups. For those who fall in a monocultural mindset (see continuum in Figure 2), having a strong cohesive culture could potentially impede changes in their attitudes toward different cultures. This research was approved through the Institutional Research Board (IRB-0172).

This study focused on two hypotheses.

> H1: Engineering students exposed to classroom cross-cultural training incorporating different methods and content will show significantly improved cultural competency.
>
> H2: Engineering students who begin the training with a cohesive group that has a strong culture (the Army Captains) will show less improvement in cultural competency through classroom training.

These hypotheses were tested by surveying students with the Intercultural Development Inventory (IDI) over several semesters.

Methods

Global Project Management Class. This graduate course focuses on best practices of managing global projects. Traditionally, as the instructor, I have focused extensively on differences in country cultures. These differences include customs, laws, policies and ethics. In reference to the Cross-Cultural Training categories shown in Figure 1, my class uses lecture material and tools such as Hofstede's Cultural Dimensions [16] to provide Intellectual-Cultural general training. Several cases used during the semester focus on specific country cultures which provide the students Experiential-Culture specific training. The class includes case scenarios that are both culture general and specific, which would fall mostly into experiential

training. Hence, students received some training in all four training categories developed by Gudykunst and Hammer. I administrated the IDI survey to students enrolled in this class over a three-year period, which included 177 students. However, since the survey was optional, data from 45 students was not used because they completed either the pre or the post assessment only. Data for this study was collected from the 132 students who completed both surveys.

This course is regularly offered during the spring semester to students who are on campus along with those who attend the class via web conferences (distance). These sections were designated 1A. Typically, more students are distance than on campus. In addition, I teach this course up to three times a year to cohorts of Army Captains, who take course work through Fort Leonard Wood Army Training Center and are then able to complete a Master's degree through our university. The Fort courses are eight weeks in length, meet twice as often as a standard semester course and are designated as FLW sections. Each group received the same cultural training intensity.

Data Collection. Quantitative assessments were conducted using the Intercultural Development Inventory (IDI), which is a cross-culturally validated survey. This 50-question survey is based on the Intercultural Development Continuum®, which describes a set of orientations toward cultural differences and commonality that fall along a continuum [17]. On one end of the continuum, is the mono-cultural mindset beginning with mindset of denial in which differences are not seen as cultural. On the other end of the continuum is that of an intercultural mindset of adaptation. With more experience and exposure to different cultures, people tend to progress along the continuum toward a more intercultural mindset and the greater ability to accept and adapt to difference country cultures. This continuum is shown in Figure 2 where the quantitative values are between 50 and 145. The accepted breakpoints are: Denial: 50-69; Polarization: 70-85; Minimization: 86-115; Acceptance: 116-130; Adaptation 131-145. Values near a new orientation level are considered to be on the cusp of that orientation category.

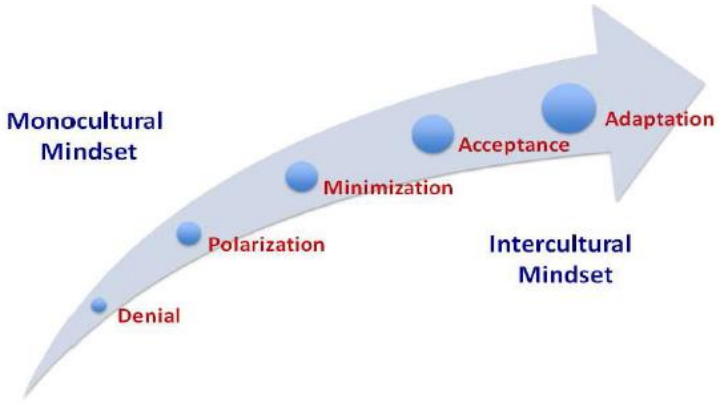

Figure 2: Intercultural Development Continuum [17]

Pre and Post training assessments were conducted for each class. The author is a qualified administrator of the IDI and administered the surveys as a part of the course. Using a Likert scale, the overall values range as described previously. For the purpose of this study, I generated group reports identifying both the Perceived Orientation (PO) and Developmental Orientation (DO) for each class. PO is a measure based on their own perceived position on the continuum,

which for most people score higher than their DO values. Individual reports and customized Intercultural Development Plans designed by IDI, LLC to aid in increasing cultural competence were created upon request of the students after the post assessments were conducted. For students who requested their individual results, I also discussed the information within their Intercultural Development Plans. These plans include non-specific suggestions for moving toward the right in the continuum and include items such as reading books or watching movies on specific cultures.

Results

The purpose of this study was to measure the difference in cultural competency from before and after classroom training on differences in country culture. Overall average results showed little difference in either of the two groups tested. Values for the developmental orientations (DO) for the 1A students are shown in the Figure 1 with both pre and post tests shown. Figure 2 shows the values for the developmental orientations (DO) for the FLW students, again with both pre and post tests shown.

The raw data for 1A students (n=27) shows that five people moved along the continuum to the right between the pre and-post tests, while four students moved to the left. Figure 3 shows 3.7% of students (1 student) are in Adaptation after the post-test. Again, comparisons of the pre and post-tests also show that the same number of students were in Minimization with none in Acceptance for either case. For Polarization orientation, ten students (37% of 27) showed that orientation in the pre-test while only eight students (29.6% of 27) tested in that orientation with the post-test. Four students scored in Denial (37% of 27) in the pre-test with five testing in Denial in the post-test. One person who scored in Adaptation for the post-test was in Minimization orientation after the pre-test, which means that one person moved from Polarization to Denial and one person moved from Polarization to Minimization.

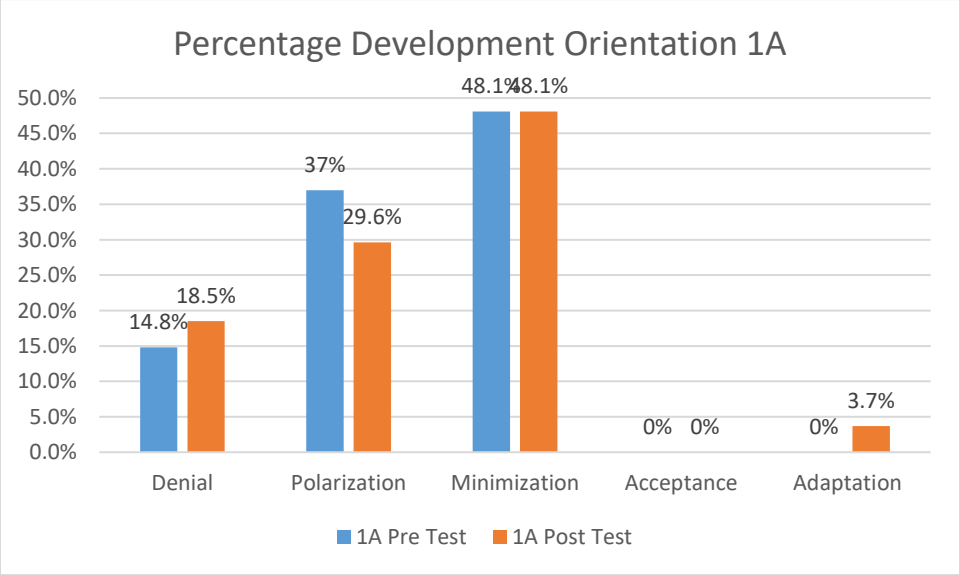

Figure 3: 1A Student DO pre and post results (n=27)

Comparison of the raw data for individual pre and post-test scores for the FLW students (n=105) showed that 30 students moved to the right in the orientation continuum in between the pre and post-tests. However, 12 students moved back toward the left in the continuum between the two tests. As shown in Figure 4, a shift is seen toward the right of the continuum with fewer students in Denial. In addition, two students test in Adaptation (1.9% of 105) for the post-test where none tested in that orientation in the pre-test. Four students tested in Acceptance (3.8% of 105) in the post-test, while only three tested in that orientation for the pre-test. The FLW class also showed a lower percentage in the Minimization category with a higher percentage in Denial initially and slightly higher percentage in Polarization.

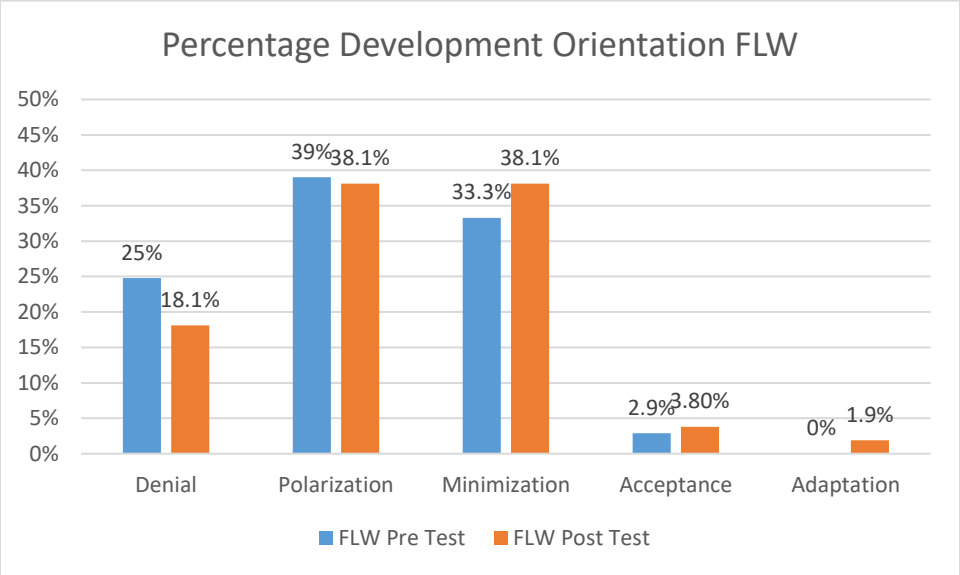

Figure 4: FLW Student DO pre and post results (n=105)

The average results for the PO and DO for each class are shown in Table 1 where n = number of students and σ is standard deviation. Again, a total of 132 students were tested. One section of FLW classes (FLW Summer 2017) showed average increase of 9 points for the DO, but one section (FLW Fall 2018) showed a slightly lower DO average value for the post-test. Other sections showed little or no average improvement.

For the first hypothesis, the differences in average values of DO did not support the statement. However, approximately 26.5% (35 total) of the students tested improved their orientation level from the pre-test to the post-test. Conversely, 12% (16 total) of the students tested at a lower orientation level after the training. The most significant overall average change for a course occurred in the FLW Summer 2017 section in which the class average post-test DO increased by 9 points over the pre-test. With the second hypothesis, I assumed that the 1A students would outperform the FLW students in the post-tests, which did not happen.

Table 1: Results of IDI Surveys

Class Section	n	Pre PO ±σ	Pre DO ±σ	Post PO ±σ	Post DO ±σ
1A Spring 2018	17	118.34 ± 5.88	85.322 ± 13.86	119.15 ± 7.65	85.972 ± 18.63
1A Spring 2019	10	118.9 ± 3.99	85.629 ± 10.38	120.43 ± 5.15	89.497 ± 12.73
FLW Summer 2017	21	117.47 ± 6.04	81.408 ± 15.06	121.77 ± 8.62	90.635 ± 20.8
FLW Fall 2017	15	115.95 ± 5.66	76.293 ± 14.02	117.56 ± 10.58	78.122 ± 27.53
FLW Fall 2018	22	118.27 ± 6.51	83.114 ± 15.55	118.05 ± 6.57	81.919 ± 16.31
FLW Spring 2018	15	121.04 ± 5.33	88.016 ± 12.27	122.41 ± 6.37	91.286 ± 16.11
FLW Summer 2018	13	118.45 ± 6.87	84.395 ± 14.46	119.97 ± 6.84	86.845 ± 14.99
FLW Spring 2019	19	117.25 ± 5.02	82.883 ± 12.04	117.38 ± 5.94	82.716 ± 16.54

Conclusions

With pressure for academia to produce engineering students who are globally competent, I wanted to evaluate if cultural training incorporated within a semester class could improve cultural competency. Based on the results, one conclusion is that a single class is not enough in itself to improve cultural competency for a majority of engineering students. For some students, one class could be effective given other cultural experiences. I met with one distant student who saw an improvement from Minimization to Adaptation during the class. When I asked what she believed was the reason for such a large jump in DO, she answered that her recent work experiences combined with the training just "clicked" for her. Why some students actually tested at a lower value for DO after the training is not fully understood, but could have resulted if the ideas presented in class challenged their own ideas causing a push back against the training.

My results, along with previous studies, lead me to the conclusion that in order to produce globally competent engineering students, one or two isolated experiences will most likely not be enough for most students. Cultural changes tend to occur over longer periods of time. If true, our curriculum should provide multiple opportunities throughout the student's time at the university. Providing those opportunities throughout would require a shift in how students are educated to a more holistic approach. Cultural training could be incorporated into courses at all levels using cases or scenario training. Experiences outside the classroom such as Service Learning that cross country borders or just provide exposure to people from different areas could be helpful. Incorporating projects and/or scenario training into freshmen level through Senior Capstone courses would provide that holistic approach that over time might prepare students more effectively.

Certainly, more research is needed in this area. For this study, understanding the experiences and backgrounds of the students within the study could support or dispute my conclusion. The addition of an exit interview for students could also provide insight into changes in cultural competency. However, the IDI surveys almost always show a higher perceived cultural competency than the actual measured developmental level which would need to be taken into consideration. Evaluating training or experiences incorporated into classes at multiple levels would provide a better picture of whether my conclusions are correct. I have incorporated a Service Learning project for people in another culture for a Senior Capstone course. These

students did not travel to that location but needed to learn about the culture in order to create a design that was effective. Based on the research shown in this paper, one project most likely was not sufficient to increase cultural competence. However, if students are exposed to many experiences over their college careers, I believe that they will in fact be better prepared for a global world.

This work was funded in part by a grant from my University through the Campus Committee for Diversity and Inclusion.

References

[1] A. Parkinson "The Rationale for Developing Global Competence," *Online Journal for Global Engineering Education*: Vol. 4:Iss. 2, Article 2, 2009 [Online] Available at: http://digitalcommons.uri.edu/ojgee/vol4/iss2/2http://digitalcommons.uri.edu/ojgee/vol4/iss2/2
[2] C. Del Vitto ,"Cross-Cultural "Soft Skills" and the Global Engineer: Corporate Best Practices and Trainer Methodologies," *Online Journal for Global Engineering Education*: Vol. 3: Iss. 1, Article 1, 2008 [Online] Available at http://digitalcommons.uri.edu/ojgee/vol3/iss1/1http://digitalcommons.uri.edu/ojgee/vol3/iss1/1
[3] R. Bean, "Cross-cultural Training and Workplace Performance", *National Centre for Vocational Education Research (NCVER),* Australian Government, 2008.
[4] *Accreditation Board for Engineering and Technology, Inc. (ABET),* Outcomes for Engineering Curriculum, 2019.
[5] D. May and A.E.Tekkaya, "The Globally Competent Engineer," *in IEEE International Conference on Interactive Collaborative Learning 2014, Dubiai, UAE,* December 3-6. 2014.
[6] S.A. Rajala "Beyond 2020: Preparing Engineers for the Future", *Proceedings of the IEEE,* Vol 100, DOI:10.1109/JPROC.2012.2190169, 2012.
[7] S. P. Hundley and L.G. Brown, "The Attributes of a Global Engineer Project: Updates, Inputs, Faculty Development Considerations," *in the ASEE National Conference,* June 22, 2013, Atlanta, GA.
[8] S. S. Klein-Gardner and A. Walter, "Defining Global Competence for Engineering Students", *in the ASEE National Conference,* June 21, 2011, Vancouver, Canada.
[9] K. Paterson, C. Swan and D.W. Watkins, "Going is Not Knowing: Challenges in Creating Intercultural Engineers", *in the ASEE National Conference,* June 26-29, 2016, New Orleans, LA.
[10] T. Goldfinch, P. Abuodha, G. Hampton, F. Hill, L.A. Dawes, and T. Giles (2012) "Intercultural competence in engineering education: who are we teaching?" *InMann, Llewellyn & Daniel, Scott (Eds.) Proceedings of the 23rd Annual Conference of the Australasian Association for Engineering Education*
[11] G. Maharaja (2018), "The Impact of Study Abroad on College Students' Intercultural Competence and Personal Development", *in International Research and Review: Journal of Phi Beta Delta Honor Society for International Scholars,* Vol. 7, No. 2, Spring 2018.
[12] B. K. Jesiek, Y. Shen and Y. Haller, "Cross-Cultural Competence: A Comparative Assessment of Engineering Students" *International Journal of Engineering Education,* Vol. 28, No. 1, pp. 144-155, 2012, Great Britain.
[13] W.B. Gudykunst and M. R. Hammer (1983), "Basic Training Design: Approaches to Intercultural Training," in *Handbook of Intercultural Training: Issues in Theory and Design*, eds. D. Landis and R.W. Brislin, New York: Pergamon

[14] J. F. Puck, M. G. Kittler and C. Wright, “Does it really work? Re-assessing the impact of pre-departure cross-cultural training on expatriate adjustment,” *The International Journal of Human Resource Management*, Vol. 19, No. 12, pp. 2182-2197, December 2008.
[15] L. A. Krishnan, C. Masters, H. Holgate, C. Wang and C. A. Calahan, "Structured Study Abroad Enhances Intercultural Competence," *Teaching and Learning in Communication Sciences & Disorders*: Vol. 1, Iss. 1, Article 5. DOI: doi.org/10.30707/TLCSD1.1Krishnan Available at: https://ir.library.illinoisstate.edu/tlcsd/vol1/iss1/5, 2017.
[16] [1] G. Hofstede, Hofstede Insights, available at https://www.hofstede-insights.com/product/compare-countries/
[17] M. R. Hammer, M. J. Bennet and R. Wiseman, “Measuring Intercultural Sensitivity,” in R.M. Paige (Ed.), *Education for the Intercultural Experience*, Intercultural Press, Yarmouth, ME, pp. 21-71, 2003.