**Purdue's Engineer of 2020**
**2010-2011 Seed Grant Program**
**Purdue University**

**Project Title:** Assessment of Global Learning Opportunities of Purdue University's College of Engineering

**Total Budget Requested:** $39,927.00

**Target Attribute(s) to be studied/implemented:** Multiple, see Table 1

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## A. Project Description:

### 1. Objective

The purpose of this study is to determine the degree to which selected global learning portfolio activities of the College of Engineering meet a set of global competency attributes. The primary focus is upon departmental study abroad (approximately 50 students annually distributed among 3-4 programs), Global Design Teams (approximately 50 students annually distributed among 4-5 programs), and ENGR 103 - Introduction to Global Engineering (approximately 30 students annually).

### 2. Background

All fields of study are expected to be influenced by globalization: the engineering profession is not an exception. Globalization has and will continue to impact conventional perceptions of the field and consequently, the preparation for professional practice of students graduating from engineering programs. Students must be prepared to work effectively in and with the complexities of new and diverse environments that are the new reality of their profession. Researchers, scholars, and academicians have developed a variety of conceptual models and programs which are aimed at increasing the global competence of tomorrow's engineers.

No consensus exists among the engineering education community on how to assess engineering-specific global competencies, and this is largely due to the lack of a clear definition of 'global competence' and its attributes. Most published assessment methods focus on measuring the outcomes of international experiences (such as study abroad), or specific curriculum activities offered in different academic institutes (Lohmann, 2006). Several institutes offer specific programs that aim to train globally competent professionals: in the engineering discipline, a few examples include John Brown University (Bland, 2008), Virginia Polytechnic Institute and State University, Colorado School of Mines (Downey, Lucena, & Moskal, 2006), California Polytechnic State University (Widmann & Vanasupa, 2008), Purdue University (Allert & Atkinson, 2005; Allert, Atkinson, Groll, & Hirleman, 2007), Colorado State University and Oklahoma State University (Bielefeldt & High, 2007) and Georgia Institute of Technology (Lohmann, 2006; Georgia Institute of Technology, 2005). Most of these programs (e.g., GEARE program at Purdue University) involve either short-term or semester long experiences with specific internationally focused curricula (e.g., global senior capstone course at California Polytechnic State University). In most cases, the assessment of global competencies is based on the measurement of course outcomes from these programs; fewer programs have developed some kind of assessment tools for global competencies.

There is an absence of a widely accepted and reliable measure of global competence. Instruments have been developed by Mohtar, et al., to evaluate the degree to which target programs/courses bring about movement in the demonstration of global competency attributes. In alignment with the belief that a broader, multi-dimensional framework is necessary to adequately assess global competence, this research team (Imbrie, Mohtar, Çiftçi, Tanner and Dare) proposes a conceptual model of global competence that will serve as a guide to the development of an instrument for assessing global competence in engineers. This conceptual model includes the factors that influence global competence, such as institution, faculty, and individual background, as well as the technical, professional, and individual-specific attributes by which global competence can be measured. This team is looking not only at the relevant attributes, but also at the appropriate methodologies for assessing how well Purdue Engineering global offerings help students achieve these attributes (Mohtar, et al., 2009).

Another method for assessing how global learning activities address attributes of global competence is the use of reflective journals, which can benefit students participating in service-learning-type activities by causing them to reflect on their experiences and by serving as an outlet for any frustrations encountered (Bielefeldt, Paterson, & Swan, 2009). Such reflective practice allows full and thoughtful recognition of the value of the experience and serves as an instrument for assessment. Journals may be coded for instances of commentary related to themes of interest in order to extract quantitative information from a qualitative context (McCormick, Swan, & Matson, 2008; Svarovsky & Shaffer, 2006). The rich

qualitative nature of the information provided through journal entries can provide insight to psycho-social-type processes such as changes in attitudes, empathy, and personal identity (Bielefeldt, et al., 2009). Schön (1984) describes reflective practice as a process in which the practitioner is engaged in a dialogue with the materials and situation in which s/he is involved.

Reflective practice requires one to look at the old/new project with critical, evaluative, open-minded ideas. Reflective practice questions assumptions carried into everyday situations and enables the practitioner to grasp that "reality" includes not only tangible, measurable effects (such as a rainy day), but also the social and emotional implications of those effects (i.e. that rainy days are 'sad', or that a rainy day means more productive crops, or *another* rainy day may mean a flooded basement, expensive repairs, or damaged crops). Physical reality is interpreted within the social context in which it occurs and requires one to 'step back' at critical junctures to observe rather than taking for granted that one *knows* what is happening. Such observations can lead to novel and useful solutions, or may provide insight into a potential consequence that might otherwise be overlooked. Reflective practice also requires attention to the situation presenting itself, and to the person, who must not only observe the process, but also decide on a course of action. The process requiring intervention, be it a labor dispute, crop failure, or resource shortage, must be addressed not only the physical problem, but a social one as well: reflective thinking allows us to learn so that projects can be more successful.

***Ongoing Research***

As a starting place for measuring the global competence of engineering students, Mohtar, Jevremovic, and Chang proposed a set of global engineering attributes (Table 2) mapped from Purdue's Engineer of 2020 target attributes (Table 1). The attributes in Table 1 were developed by the Purdue University's Engineer of 2020 committee and mapped from the attributes proposed by the National Academy of Engineers in their publication: The Engineer of 2020 (NAE,2004). The Global Engineering Program considers the bold face attributes as those that can be enhanced through global learning experiences. For example, a student can develop more effective leadership skills by working in multi-cultural teams; however, a student's science and math skills can be improved by curricular changes at home and do not require international activity to achieve increased scope. From the highlighted attributes, a new set of attributes were derived that are considered to represent those relevant to increased global competence for engineers.

| Abilities | Knowledge | Traits |
|---|---|---|
| ▪ **Leadership**<br>▪ **Teamwork**<br>▪ **Communication**<br>▪ **Decision-making**<br>▪ **Recognize & manage change**<br>▪ **Work effectively in diverse & multi-cultural environments**<br>▪ **Work effectively in the global engineering profession**<br>▪ **Synthesize engineering, business, and societal perspectives** | ▪ Science & Math<br>▪ Engineering fundamentals<br>▪ Analytical skills<br>▪ **Open-ended design & problem solving skills**<br>▪ **Multidisciplinary within & beyond engineering**<br>▪ Integration of analytical problem solving and design skills | ▪ **Innovative**<br>▪ Strong work ethic<br>▪ **Globally, socially, ethically, intellectually, and technologically responsible**<br>▪ **Adaptable in a changing environment**<br>▪ Entrepreneurial and intrapreneurial<br>▪ **Curious and persistent life-long learners** |

**Table 1:** Purdue's Engineer of 2020 Target Program Attributes, as they are viewed by Purdue Engineering faculty (Source: https://engineering.purdue.edu/Engr/Academics/Engineer2020/)

Instruments have been developed, based on the attributes in Table 2, to evaluate the degree to which target programs/courses bring about movement in the demonstration of these attributes, and will explore the relationships between the degree of movement, length of stay, the year in school, and the project location or travel destination.

## 3. Proposed Protocol

### *Program assessment*

Students will be asked to participate in a pre-/post- course assessment that monitors the efficacy of the program offering in meeting the global competency attributes, as reflected in Table 1. A pre- and post-assessment with matched items, using a Likert Scale was developed to evaluate the degree of exhibition of global competency attributes (Table 2).

| Global Professional Competence | Global Technical Competence | Global Social – Cultural Competence |
|---|---|---|
| ▪ Taking risks and acting independently<br>▪ Adapt knowledge to local conditions<br>▪ Analyze problems from a different cultural frame of reference<br>▪ Communicate across cultures effectively through technology | ▪ Use of international standards and codes<br>▪ Global product platform<br>▪ Applying familiar concepts to unfamiliar real-world problems<br>▪ Use of design tools | ▪ Learn and practice social and cultural responsibility<br>▪ Foreign language practice<br>▪ Cross-culturally adaptive/flexible<br>▪ Students contribution to a culture diverse teams |

**Table 2:** Purdue University's Global Engineering Program "Global Competency Attributes" (Source: Global Engineering Program, Mohtar, Jevremovic, Chang, 2008)

The pre-assessment will be administered to students participating in the named global learning portfolio activities at the beginning of a semester. Subsequently, the post course assessment will be administered, either at the end of the semester or following their return from travel, whichever is relevant to the particular student. Post-assessments for programs ending outside of the academic semester will be administered using a secure online platform. Data collected from the pre- and post-evaluations will be compared using one-tailed t-tests. An average response will be calculated for each item, in both the pre- and post- assessments. A 95-percent confidence interval ($\alpha = 0.05$) will be used to determine significance. The instrument is also available to administer to the course instructor at the completion of the course. This instrument will evaluate whether the instructor intended or believed they were addressing the global competency attributes during the course. Finally, for programs with an identifiable host (i.e. Global Design Teams) some of the items from the instrument will be directed to that individual via telephone interview. The host will be asked to comment upon the quality of the design, with regard to appropriateness (sustainability and user-centeredness) and acculturation of the students while visiting the project location.

### *Journals (for Global Design Teams)*

Students will reflect upon their participation in the Global Design Team through required journal entries, done weekly during the semester and daily while traveling. Journal entries may be written and submitted as a group, but personal journals will be encouraged as well. In-semester journal entries will include information about progress on the project, distribution of work-load, interaction with the partner organization's contact person, interaction with technical advisors, challenges, surprises, non-technical learning experiences (cultural, social, etc.) and anything else that seems relevant to the student. Journal entries during travel will include information about daily activities, contacts made in host country, interactions with hosts, notes on culture, challenges, surprises, and photos to supplement the journal entries. Some guiding questions will be provided to the students to aid them in writing a beneficial reflective journal entry.

The journals will be coded for instances of commentary related to the global competency attributes of Table 2. Examples of the proposed analytical codes are presented in Table 3. Though analysis of the journals the researcher will be able to determine which of the attributes are being addressed, and which may need to be explicitly addressed through changes in course structure. Analysis will also provide insight into the triggers which prompt students to manifest certain attributes.

| Code/Attribute | Description | Example(s) |
|---|---|---|
| Communicate across cultures effectively through technology | Comments regarding communication with international partner | "We Skyped with Busia and asked him questions about common irrigation practices in Ghana."<br>"The email Amjad sent this week was very helpful in helping us move forward with the database." |
| Applying familiar concepts to unfamiliar real-world problems | Comments regarding using previously learned skills and knowledge and applying it to the design at hand | "When I was interning for the USDA, we designed spring developments for livestock which might work for this location."<br>"Think about how simple the steering is on your riding lawnmower… maybe that is something we can apply here." |

**Table 3:** Sample analytic codes for analysis of qualitative data

## 4. Outcomes

It is expected that some positive movement between the pre- and post- assessments of these global learning portfolio activities will be observed. Initial applications of the instrument have indicated some personal interpretation with the items, and those issues have since been addressed. Additionally, these initial trials have indicated statistically significant increases in subscription to the attributes being measured.

### *Implications*

This study will provide insight into the quality, with regard to their ability to meet pre-defined attributes of global competence, of some key international programs offered by the College of Engineering, as well as ways in which to improve these programs. Such information should become a useful marketing tool with which to increase interest in the programs and will serve as a guide in the development of more comprehensive instruments.

### *Applications*

This research will provide insight to the adequacy and efficacy of our global learning portfolio at Purdue and possible directions for their increased funding. The outcomes are expected to impact the engineering curriculum at Purdue University by identifying attributes that must be addressed as the curriculum is developed. Application of the outcomes will also impact the types of opportunities offered to students and be useful to faculty in building opportunities that contribute effectively to increased global competence of our students.

### *Dissemination of results*

Research outcomes will be shared within the College of Engineering as internal documents that offer recommendations intended to assist in the development of more effective international programs. Likewise, results will be published in the appropriate professional literature and shared in conferences, symposia and similar scientific meetings, such as the Annual Colloquium on International Engineering Education, to promote discussion and refinement of next steps in the research and development of these instruments.

## B. Timeline and Implementation Strategy

### 1. Timeline

| | |
|---|---|
| March - April 2010 | Pre-assessments to Maymester study abroad |
| May 2010 | Maymester travel |
| June - July 2010 | Post-assessments to Maymester study abroad |
| August 2010 | Pre-assessments to ENGR 103 |
| November 2010 | Post-assessments to ENGR 103 |
| January - February 2011 | Pre-assessments to Global Design Teams and ENGR 103,<br>Pre-assessments to Spring Break study abroad |
| March –April 2011 | Spring Break travel, Post-assessments to Spring Break study abroad<br>Pre-assessments to Maymester study abroad<br>Post-assessments to ENGR 103 |
| May 2011 | GDT and Maymester travel |
| June – July 2011 | Post-assessments to Maymester study abroad and Global Design Teams |
| July 2011 | Complete data analysis and report |

| Mar-Apr 2010 | May 2010 | Jun-Jul 2010 | Aug 2010 | Nov 2010 | Jan-Feb 2011 | Mar 2011 | May 2011 | Jun-Jul 2011 |
|---|---|---|---|---|---|---|---|---|
| | Maymester **travel** | | | | | Spring Break **travel** | GDT Maymester **travel** | |
| **Pre-assess** Maymester, | | | **Pre-assess** ENGR 103 | | **Pre-assess** GDT, ENGR 103, Spring Break | **Pre-assess** Maymester | | |
| | | **Post-assess** Maymester | | **Post-assess** ENGR 103 | | **Post-assess** Spring Break ENGR 103 | | **Post-assess** Maymester GDT |
| *data analysis* | *data analysis* | *data analysis* | *data analysis* | *data analysis* | *data analysis* | *data analysis* | *data analysis* | *final report* |

### 2. Implementation Strategy

Outcomes from this study will be shared with stakeholders at Purdue working in areas relevant to international engineering education and international program offices. Research outcomes will be shared with faculty instructors via a seminar aimed to develop global courses that are effective at addressing attributes of global competence, while optimizing the time and energy of the stakeholders.

**C. Personnel Requirements**

Please indicate the portion of FTE that each faculty member will dedicate to the project

| Faculty member | Summer 2010 | Fall 2010 | Spring 2011 |
|---|---|---|---|
| Rabi Mohtar | 1.25% | 1.25% | 1.25% |
| PK Imbrie | 1.2% | 1.2% | 1.2% |
| Ayşe Çiftçi | 1.2% | 1.2% | 1.2% |
| | | | |
| | | | |

**D. Budget**

Faculty/Staff Member Funding

*Please indicate the funding (dollars and time) you are requesting for the grant for this project)*

| | Grant funds requested | | |
|---|---|---|---|
| Faculty/Staff Name: | % Time | Fringe Benefits | $$ |
| Rabi Mohtar | 1.25% | $507.00 | $1,359.00 |
| PK Imbrie | 1.2% | $432.00 | $1,157.00 |
| Ayşe Çiftçi | 1.2% | $274.00 | $735.00 |
| | | | |
| | | | |
| Subtotal Faculty/Staff Funding | | $ 1,213.00 | $ 3,251.00 |

Graduate Students

| | Grant funds requested | | | |
|---|---|---|---|---|
| Type of position | % Time | Insurance + Fee Remit | Fringe Benefits | $$ |
| Graduate Research Assistant | 100% | $9,473.00 | $94.00 | $18,896.00 |
| | | | | |
| | | | | |
| | | | | |
| Subtotal Grad Student Personnel | | $ 9,473.00 | $ 94.00 | $ 18,896.00 |

Undergraduate Student Funding

*Please indicate the student resources (funding and time) you are requesting from the grant for this project.*

| | Grant funds requested | | |
|---|---|---|---|
| Type of position | Hrs/week | Fringe Benefits | $$ |
| | | | |
| | | | |
| | | | |
| | | | |
| Subtotal Undergrad Student Personnel | | | |

Equipment $ Software Funding

*Please list all specialized equipment and software required for the project. (Do not include standard computer equipment and commonly-available software, e.g. Microsoft Office, Microsoft Windows). Mark whether any of the equipment or software is provided by the department. (Note that only 10% of the funds can be used to purchase equipment and it needs to be dedicated to the goals of the project.*

| Name of Equipment | Funds Requested |
|---|---|
| | |
| | |
| | |
| Subtotal Equipment | $0.00 |
| Name of Software | |
| | |
| | |
| | |
| | |
| Subtotal Software | $0.00 |
| Other miscellaneous items | |
| Office supplies (paper, printing, reproduction) | $1,000 |
| Communications (telephone, postage) | $500 |
| | |
| | |
| Subtotal miscellaneous | $1,500.00 |
| Other expenses | |
| Two persons travel to Annual Colloquium on International Engr. Ed. September 2010, Newport, Rhode Island | $2,000 |
| One person travel to Capstone Design Conference June 2010, Boulder, Colorado | $1,000 |
| One person travel to international conference TBD | $2,500 |
| | |
| Subtotal other expenses | $5,500 |

**E. Budget Justification**

This budget represents funding necessary to sponsor one graduate research assistant to complete the data collection and analysis for this study and to provide that student with appropriate faculty support. Office supplies (paper, printing, reproduction), communications (telephone, internet, computer, postage) will be incurred through the administration of this assessment. In keeping with the plans for dissemination, results will be shared in conferences, symposia and similar scientific meetings, such as the Annual Colloquium on International Engineering Education, Capstone Design Conference, and one other international conference such as the ASEE Global Colloquium, or other relevant venue.

## F. References


Allert, B. I., & Atkinson, D. L. (2005). *Identifying learning outcomes of a multi-semester international program in mechanical engineering.* Paper presented at the 35th Annual ASEE/IEEE Frontiers in Education Conference.

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Bielefeldt, A. R., Paterson, K. G., & Swan, C. W. (2009). *Measuring the impacts of project-based service learning.* Paper presented at the ASEE Annual Conference, Austin, TX.

Bland, L. (2008). *Providing Engineers Cross-Cultural Experiences: Is it truly needed?* Paper presented at the Proceedings of the 2008 Christian Engineering Educators Conference.

Downey, G. L., Lucena, J. C., & Moskal, B. M. (2006). The Globally Competent Engineer: Working Effectively with People Who Define Problems Differently. [Feature]. *Journal of Engineering Education, 95*(2), 107-122.

Georgia Institute of Technology. (2005). *Strengthening the Global Competence and Research Experiences of Undergraduate Students: A Quality Enhancement Plan*.

Lohmann, J. A., Rollins Jr., H. A., & Hoey, J. J. (2006). Defining, developing and assessing global competence in engineers. *European Journal of Engineering Education, 31*(1), 119-131.

McCormick, M., Swan, C., & Matson, D. (2008, June). *Reading between the lines: Evaluating self-assessments of skills acquired during an international service learning project.* Paper presented at the ASEE Annual Conference and Exposition, Pittsburgh, PA.

Mohtar, R.H., Imbrie, P.K., Ciftci, A., Dare, A., & Tanner, S. (2009, October). *Global Engineering Competencies.* Poster session presented at the 12th Annual Colloquium on International Engineering Education, Ames, IA.

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Schön, D. (1984). *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.

Svarovsky, G. N., & Shaffer, D. W. (2006). *Design meetings and design notebooks as tools for reflection in the engineering deisgn course.* Paper presented at the 36th Annual ASEE/IEEE Frontiers in Education Conference, San Diego, CA.

Widmann, J., & Vanasupa, L. (2008). *Work in progress: Attaining and measuring global competency for engineering graduates.* Paper presented at the 38th Annual ASEE/IEEE Frontiers in Education Conference.

## G. BIOGRAPHICAL SKETCH


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**(i) Professional Preparation**

**Undergraduate**

American University of Beirut, Beirut, Lebanon
Agricultural Engineering, 1983

**Graduate**

1. American University of Beirut, Beirut, Lebanon
   Irrigation Science, M.Sc. 1985
2. Michigan State University, East Lansing, Michigan, USA
   Civil & Environmental Engineering, M.Sc. 1992
3. Michigan State University, East Lansing, Michigan, USA
   Agricultural Technology and Systems Management, Ph.D. 1994

**(ii) Appointments**

- 2008, Director of Global Engineering Program, College of Engineering, Purdue University, W. Lafayette, IN
- 2006, Professor, Agricultural & Biological Engineering, Purdue University, West Lafayette, IN
- 2002, Associate Professor, Agricultural & Biological Engineering, Purdue University, West Lafayette IN
- 1996, Assistant Professor, Agricultural & Biological Engineering, Purdue University, West Lafayette IN

**(iii) Recent Related Publications**


1. Abou Najm, M., **R.H. Mohtar**, J. Weiss, and E. Braudeau. 2009. Assessing internal stress evolution in unsaturated soils. Water Resources Research. *Water Resources Research*. VOL. 45, W00C11, doi:10.1029/2007WR006484, 2009. Featured in *Ecology, Environment and Conservation*. Atlanta: Feb 27, 2009. P. 273.
2. Ouessar, M., A. Bruggeman, F. Abdelli, **R.H. Mohtar**, D. Gabriels, and W. Cornelis. 2009. Modelling water-harvesting systems in the arid south of Tunisia using SWAT. Hydrology and Earth System Sciences Discussions. *Hydrology and Earth System Sciences*, 13:2003-2021, 2009. www.hydrol-earth-syst-sci.net/13/2003/2009/
3. Braudeau, E., and **R.H. Mohtar.** 2009. Modeling the Soil System: Bridging the Gap Between Pedology and Soil-Water Physics. Global Planetary Change (special issue for Land Use). *Global Planetary Change* (special issue for Land Use). doi: 10.1016/j.gloplacha.2008.12.002
4. Belhouchette, H., E. Braudeau, **R. H. Mohtar**, M. Donatelli, and Wery. 2008. Integrating Spatial Soil Organization Data with a Regional Agricultural Management Simulation Model: a Case Study in Northern Tunisia. Transactions of the ASABE. 51(3): 1099-1109.
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7. Miller, P.S., **R.H. Mohtar**, and B.A. Engel. 2007. Analysis of common water quality monitoring schemes and their effects upon mass load calculation. Transactions of the ASAE 50(3):817.829.
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11. Rahbeh, M.E. and **R.H. Mohtar**. 2006. Application of Multiphase Transport Models to Field Remediation by Air Sparging and Soil Vapor Extraction. *Journal of Hazardous Materials*. doi:10.1016/j.jhazmat.2006.09.098.
12. Rahbeh, M. and **R.H. Mohtar**. 2006. Modeling Multiphase Contaminant Transport in Porous Media using First Order Mass Transfer Kinetics. *Transactions of the ASABE.* 2006: 49(6).
13. Zhai, T., **R.H. Mohtar**, A.R. Gillespie, G.R. von Kiparski, K.D. Johnson, and M. Neary. 2006. Modeling forage growth in a Midwest USA silvopastoral System. *AgroForestry Systems* (2006) 67:243-257. DOI 10.1007/s10457-005-3823-0.
14. Aguirre, C.G., A. Madani, **R.H. Mohtar** and K. Haghighi. 2005. Deterministic finite element solution of the unsteady water and transient transport through porous media: model development. *Canadian Biosystems Engineering* (47): 1.29-1.35.
15. Sammons, R.J., **R.H. Mohtar** and W.J. Northcott. 2005. Modeling Subsurface Drainage Flow of a Tile-Drained Small Watershed using DRAINMOD. *Applied Engineering in Agriculture* 21(5):815-834.

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21. Jaber, F. and **R.H. Mohtar**. 2003. Stability and accuracy of two-dimensional kinematic wave overland flow modeling. *Advances in Water Resources* 26(2003)1189-1198.
22. Benner, M.L., **R.H. Mohtar** and L.S. Lee. 2002. Factors affecting air sparging remediation systems using field data and numerical simulations. *Journal of Hazardous Materials.* B95(2002) 305-329.
23. Jaber, F.H. and **R.H. Mohtar**. 2002. Dynamic Time Step for One-Dimensional Overland Flow Kinematic Wave Solution. *Journal of Hydrologic Engineering*, ASCE 7(1): 3-11.

**(iv) Synergistic Activities**

Professor Mohtar integrated research from field and lab into multimedia computer technologies in order to develop water quality and hydrologic system research programs that can be used by others. He led the development of a new paradigm in multi-scale soil water characterization and modeling which distinguishes between the micro, macro, crack and local water exchange within the representative elementary structural volume. The model characterizes the medium considering the soil shrinkage, swelling, and water potential properties of the medium. He developed a methodology to upscale this methodology to landscape and watershed scales. He organized and chaired over 100 technical sessions and was invited for over 55 guest talks in 11 countries in the area of hydrologic resources and the application of numerical methods in water resources. He published over 60 peer reviewed articles in leading journals.

Professor Mohtar was elected to leadership roles in the Biological Engineering division of the American Society of Agricultural and Biological Engineers (ASABE) to addressing soil and groundwater remediation issues. He led efforts by this group to apply numerical methods to agricultural and biological engineering problems, particularly issues related to water resources, and chaired ASABE's Finite Element and Numerical Analysis Committee. He used and adapted the finite element method, spatial analysis, and other modeling tools to study complex natural resources problems and to create simulation and decision support systems that improve the management of natural resources. He chaired the Information and Electrical Technology (IET) Divisions at ASABE and serves as the associate editor for (IET) and Biological Engineering (BE) divisions of the ASABE Transactions and Applied Engineering in Agriculture.

Selected recent international activities include: an invitation to assist the US National Academies to the Symposium on Strengthening Science Based Decision-Making for Agricultural Water Management June 4-9, 2005; invitation by USDA on the US delegation to India as part of the AKI US-India research initiative, Sept 20-22, 2006. Professor Mohtar was also asked by USDA-FAS to lead the Water Quality team during the meeting and to be part of the write-up committee for the workshop outcomes. He was invited in November 2005, by the office of Her Highness Sheikha Moza Bint Nasser Al-Missned of Qatar to help organize a Qatari-Arab expatriate scientists' initiative. He currently serves on the Qatari-Arab Expatriate Scientists Joint Committee that oversees the research partnership. As a result of this initiative, the Qatar National Research Fund, the Arab Expatriate forum, and three research institutes have been launched.

**(v) Collaborators and other affiliations**

**a) Collaborators**

| | | | |
|---|---|---|---|
| Erik Braudeau | Bernard A. Engel | Fouad Jaber | Jalal Jabro |
| Amr Elnashai | Ramesh Kanwar | Roger Moussa | Ronald Turco |

**b) Graduate and Postdoctoral Advisors**

1) PhD Advisor: Larry Segerlind, Michigan State University, East Lansing, MI. Current: Professor
2) Post Doctoral Supervisor: Dennis Buckmaster, formerly Penn State, State College, PA. Current: Professor

**c) Thesis Advisor and Postgraduate-Scholar Sponsor (last 5 years)**:

1) Kathryn Northquist (MS, ABE)
2) Fouad Jaber (PhD, ABE)
3) Mike Benner (MS, ABE)
4) Xingwen Chen (PhD, ABE)
5) Hubert Montas (Post-doc Scholar)
6) Ahmad Hassan (Post-doc Scholar)
7) Tong Zhai (PhD, ABE)
8) Michel Rahbeh (PhD, ABE)
9) Rhea Sammons (MS, ABE)
10) Elizabeth Warnemunde (Post-doc Scholar)
11) Paul Miller (PhD, ABE)
12) Akilah Martin (PhD, ABE)
13) Mohammed Salahat (PhD, ABE)
14) Halis Simsek (MS, ABE)
15) Majdi Abou Najm (PhD, ABE)
16) Joseph Mallory (MS, ABE)