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# Faculty Development and International Collaborations Using Vertical Education Enhancement Model

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# Faculty Development and International Collaborations Using Vertical Education Enhancement Model

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## Abstract

This paper presents the international collaboration and experiences of an effective faculty development initiative based on a vertical education enhancement (VEE) model. The VEE faculty development program was designed to effectively improve performance and moral through life-long learning and training, mentoring, continuous assessments and improvement feedbacks, research and external funding, grant writing, seed money for research, international activities and collaborations, and increased conference participations and journal publications. The VEE model consists of three fundamental interwoven components: curriculum and mentoring; industry, government and community partnerships; and research and funding. The VEE faculty development initiative was successful implemented in a collaborative program between Alabama Agricultural and Mechanical University (AAMU) and Brookhaven National Laboratory (BNL). The results and outcomes for science, technology, engineering and mathematics (STEM) faculty members include increased participation in international education and research collaborations, and increase in the number of students engaged in research and international education activities.

## Introduction

The continuous training and professional development of faculty members is essential to the growth of higher education institutions. With increase in online and distance learning, institutions of higher education can now reach more students across the globe. It is therefore important to include international perspectives in faculty development activities. This paper presents a faculty development program that effectively engage faculty members in international research collaborations uses a *vertical education enhancement (VEE) model* that promotes vertical progression through the various levels of professional development. The VEE model has three interwoven components consisting of 1) curriculum and mentoring; 2) industry, government and community partnerships; and 3) research and funding [1].

The curriculum and mentoring component of the VEE model provides essential knowledge base and training infrastructure supports for faculty members and students. Instructional and training laboratories provide international collaborations, practical training and research activities. The mentoring system for faculty members comprise of national laboratory researchers and senior scientist that mentor faculty-student teams in research activities during the summer semesters. The summer activities include visiting/guest international scientists with whom faculty members

interact and collaborate in research and technical publications. A major part of this component is the tracking of research and education activities that uses periodic evaluation and feedback for improvement.

Industry, government and community involvements form a critical component of the VEE model. As applied to the enhancement of faculty international engagement and collaboration, industry and government agencies serve as the main sources of funding. The program discussed here was implemented at Brookhaven National Laboratory which is supported by the United States (U.S.) Department of Energy. Major funding supports for faculty training and research came from the following U.S. government agencies:

- Department of Energy (DOE).
- Nuclear Regulatory Commission (NRC).
- Department of Homeland Security (DHS).
- National Science Foundation (NSF).

## 2. Structure of the VEE model Faculty International Collaborations

The structure of the faculty international collaborations using the VEE model has several levels. It begins with faculty members, often at the junior level, developing career goals that include significant international collaborations in the areas of education and research. The next step is to identify resources and supports needed to accomplish the goals. The key resources include 1) research facilities that engage the participation of international and world-class scientists, 2) funding from industry and federal agencies that could support some level of international activities such as conference and workshop travels, and 3) research and professional mentors at national laboratories. The targeted outcomes include:

1. Research experience in the focus area of the faculty member.
2. Training of students in an international research environment.
3. Participation in international conferences by faculty members and graduate students.
4. Publication in internationally disseminated and world-class technical journals.
5. Increased external funding that could support international education and research activities.
6. Professional growth for faculty members.

## 3. International Activities

### *3.1. Summer Research and Education Activities at Brookhaven National Laboratory*

The summer research and education activities at Brookhaven National Laboratory comprised of faculty members, faculty-student teams, internal guest scientists, and BNL scientists and engineers. Major funding comes from the U.S. department of Energy. Supports for majority of faculty members and students come from the Faculty-Student Team (FaST) program that was jointly funded by the DOE and the National Science Foundation (NSF), and which has

transformed to the DOE's Faculty Visiting Program (VFP). Faculty members start with establishing research collaborations with scientists at BNL who host international guest scientists during the summer. This is followed with the development and submission of research proposals to funding agencies. Students that participate in the summer research activities gain hands-on training and experience with the use of world class research equipment and facilities. The facilities at BNL include:

1. Nuclear detector research labs at the Nonproliferation and National Security department.
2. The National Synchrotron Light Source (NSLS and NSLS-II).
3. XPS and AFM at the Center for Functional Nanomaterials (CFN).
4. Training and education resources at the Office of Educational Programs (OEP).

The research activities are in the development of room-temperature nuclear radiation detectors that are capable of operating at room-temperature without cryogenic cooling. The major room-temperature nuclear detectors studied include cadmium zinc telluride (CdZnTe) and cadmium manganese telluride (CMT). These detectors have applications in in nuclear medicine [2], medical imaging systems [3], astrophysics [4], nuclear nonproliferation, and national security.

### *3.2. Technical Publications*

Technical publications are results of the summer research activities and continued collaborations with international scientists during the fall and spring semester through results analysis and exchange of ideas. Coauthored papers are published in international technical journals and conference proceeding [5 – 25], and they also include students. These interactive data analysis and paper writing enhance the technical writing skills of participants, including students.

### *3.3. International Conferences*

The international conferences serve three purposes: results dissemination, direct interaction with a world-wide range of scientists and industries, and participation in workshops/training. The faculty members participated in the following international conferences between 2011 and 2015, some include joint conference papers with collaborating scientists from BNL and outside the United States:

- SPIE Optics and Photonics held every August in San Diego, California, USA (2011 – 2015). It is the largest international, multidisciplinary optical sciences and technology meeting in North America.
- 2012 IEEE Nuclear Science Symposium and Medical Imaging Conference, Anaheim, California, USA, October 27 – November 3, 2012.
- 2013 IEEE Nuclear Science Symposium and Medical Imaging Conference, Seoul, Korea, October 27 – November 3, 2013.
- 2014 Symposium on Radiation Measurements and Applications (SORMA XV), Ann Arbor, Michigan, USA, June 9 – 12, 2014.

- 2014 U.S. Workshop on the physics and chemistry of II-VI materials, Baltimore, Maryland, USA, October 20 – 23, 2014.
- 2014 IEEE Nuclear Science Symposium and Medical Imaging Conference, Seattle, Washington, USA, November 8 – 15, 2014.
- 2015 SPIE Optics/Optoelectronics, Prague, Czech Republic, April 13 – 16, 2015.
- 2015 ANIMMA: Advancements in Nuclear Instrumentation Measurement Methods and their Applications, Lisbon, Portugal, April 20 – 24, 2015.

## 4. Results and Conclusion

The results of the faculty development and international collaboration program are summarized in Tables 1 and 2. Table 1 shows the participating institutions and their respective countries. Table 2 show the general performance assessment results of participations in the international collaboration program. Publications resulting from research collaborations are shown in references [5] – [26].

Table 1. Participation over a four-year period (2011 – 2015).

| | **Institution** | **Country** | **Number of collaborators** |
|---|---|---|---|
| 1. | Alabama A&M University, Normal, Alabama. | USA | 10 |
| 2. | Brookhaven National Laboratory, Upton, New York. | USA | 10 |
| 3. | Chernivtsi National University, Chernivtsi 58012. | Ukraine | 5 |
| 4 | KoreaUniversity. | South Korea | 3 |
| 5. | Charles University, Ke Karlovu 5, CZ-121 16, Prague 2. | Czech Republic | 2 |
| 6. | Northwestern Polytechnical University, Xi'an, Shaanxi. | China | 1 |
| 7 | IMEM-CNR, Parma. | Italy | 1 |

In conclusion, we have successfully implemented a faculty development and international collaboration program based on a vertical education enhancement model. The results and outcomes for science, technology, engineering and mathematics (STEM) faculty members include increased participation in international education and research collaborations, and increase in the number of students engaged in research and international education activities.

Table 2. General performance metrics over a four-year period (2011 – 2015).

| | Performance Metrics | Total | Collaborative research with BNL (%) | Participated in international conference (%) | Co-authored technical papers (%) |
|---|---|---|---|---|---|
| 1. | STEM faculty members who participated in the program. | 10 | 100 | 80 | 90 |
| 2. | Graduate students who participated in the program. | 8 | 75 | 75 | 75 |
| 3. | Undergraduates who participated in the program. | 20 | 90 | 50 | 60 |
| 4. | Research scientists/mentors at Brookhaven National laboratory. | 10 | 100 | 100 | 100 |
| 5. | Research Scientists from outside the United States. | 12 | 100 | 100 | 100 |

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