

SUPPORTING UNIVERSITIES TO PARTNER ACROSS THE PACIFIC

Annual Program Statement (APS) Number Indonesia 09-014

Concept Paper

Teaching Innovation in Engineering Education (TIEE) through Discovery Learning, Distance Mentoring, and Partnership

Partnering Institutions:

- Utah State University, Logan, Utah, U.S.A. (lead institution)
 - Universitas Indonesia, Jakarta, Indonesia
 - Universitas Gadjah Mada, Yogyakarta, Indonesia
- Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
 - Universitas Hasanuddin, Makassar, Indonesia

Submitted by:

Dr. Oenardi Lawanto
Utah State University
College of Engineering
Department of Engineering and Technology Education
6000 Old Main Hill
Logan, Utah 84322-6000

email: olawanto@usu.edu
phone: (435) 797-8699

Teaching Innovation in Engineering Education (TIEE) through Discovery Learning, Distance Mentoring, and Partnership

Goals

The following are goals of the partnership:

- Establish a collaborative relationship between Utah State University and Universitas Indonesia, Universitas Gadjah Mada, Institut Teknologi Sepuluh Nopember, and Universitas Hasanuddin
- Establish a collaborative relationship between universities on Java and regional universities
- Improve the quality of teaching in engineering
- Improve research in engineering education
- Increase the use of and quality of instructional technology for distance learning

Problem Definition

One of the urgent problems facing Indonesian higher education institutions is the quality of teaching. This problem influences the quality of the graduates, which in turn, affects the national competitiveness to produce qualified professionals in critical fields of study. Higher education institutions must accept the responsibility to respond decisively to the fundamental obstacles that prevent substantial and necessary reform.

Engineering, as a profession, differs from many science and mathematics disciplines in its emphasis on creation and design rather than inquiry. Rapid changes in the worldwide engineering enterprise necessitate rethinking how future generations of engineers should be educated to build analysis-based design skills. Numerous publications have indicated a transition in the way engineers are educated [1-4], emphasizing that tomorrow's graduates will compete in a global economy marked by rapid innovation and growth, and technological advances moving at a rapid pace. Thorough integration of technology with society will challenge the analytical skills, creativity, and leadership of engineers; demand participation of engineers in public policy; and require ethical adaptations to constraints of developing countries, including Indonesia.

The rigorous research and practice of engineering education can provide the engineering discipline with the tools to develop, adopt and use proven pedagogical practices for teaching, retaining, and evaluating students. Further research is needed to lead to this practice. It is imperative to recognize that engineering education is already entering into, and belongs in, the domain of serious science with scholarly efforts promoted by the highest levels of leadership in the National Academy of Engineering and National Science Foundation.

An intervention that can enhance the quality of teaching in higher education institutions in Indonesia is a real and an immediate need. Well-designed and developed initiatives that respond appropriately to the existing problems in institutions of higher education in Indonesia will be the main objectives of this project. There are four critical points [5] that must be considered in regards to developing any initiative for teaching innovation in Indonesia:

1. From the Indonesian national perspective, there is a challenge to enhance the quality of engineering education. Strengthening the teaching quality of engineering faculty will play an essential role in supporting the national economic development.

2. Engineering education practices in Indonesia have not yet been well-developed. Most of the faculty members adopt conventional teaching approaches that focus heavily on the teacher as the central player of learning rather than the students. The use of information technology to enhance learning has been neither effectively nor efficiently implemented.
3. The institutional capacity development associated to this teaching innovation has been largely neglected; and it is in line with three pillars of development currently implemented by the Indonesian Directorate General of Higher Education (DGHE), which is to improve quality and relevance, increase access to quality education, and promote good university governance. A recent study conducted by the Indonesian DGHE showed that the higher education subsector is currently comprised of 151 public and approximately 2,766 private institutions. About 1 million students in the public and approximately 2.8 million students in private institutions are enrolled. A smaller fraction of the student population, an additional 450,000 students, is enrolled in Open University and occupational educational institutions. The current participation rate in higher education is still low (17.2%) compared to other developing countries in the regions.
4. The Indonesian DGHE consistently supports higher education institutions to develop innovations that lead to a better learning outcome for the students. Sufficient funds are allocated for faculty members to engage in this effort.

This proposed program will address the four issues described above. The direct target audience of this program is four Indonesian public universities: Universitas Indonesia (UI) in Jakarta, Universitas Gadjah Mada (UGM) in Yogyakarta, Institut Teknologi Sepuluh Nopember (ITS) in Surabaya, and Universitas Hasanuddin (Unhas) in Makassar. The program is intended to improve the teaching quality of engineering faculty at those institutions.

Technical Innovation

Introduction

Our vision is to improve the teaching and learning of engineering using a unique collaborative partnership training model that builds on active learning. This 2½-year project includes several cohorts of engineering faculty at Indonesian universities working with Utah State University, including an Indonesian national who is experienced in similar projects funded by the World Bank Institute (WBI) and who is well-versed in the Indonesian culture. This expert will strengthen the communications of the US and Indonesian partnership.

The Teaching Innovation in Engineering Education (TIEE) consists of a 6-month preparation stage, a 1½-year learning forum to enhance teaching quality in engineering education in Indonesia through the capacity building at individual and institution level, and a 6-month observation, implementation, and evaluation period.

This learning forum offers engineering faculty the opportunity to work together, through face-to-face and virtual group interactions, to improve their mastery of innovative training design, curriculum development, learning methods application, and the use of instructional technologies. Improved teaching and learning topics and research collaboration in the area of engineering education will be the focus of the project. Formative and summative evaluation of the learning forum will be conducted using various evaluation instruments and techniques. This unique project will have a substantial impact on engineering faculty and their programs.

Each partner institution will have the opportunity to select a maximum of 15 teaching faculty members to participate in phases 1 and 2. The selection is made based upon criteria such as personal interest of the faculty member in teaching innovation, the number of years of teaching experience, and English proficiency. Upon the completion of phase 2, a total of 30 participants will be selected to progress to the next phases. The selection will be made based upon the performance of each participant during phases 1 and 2.

Core principles in delivering TIEE

TIEE will be conducted using four important core principles as described below:

- **Active learning approach**
The adult learning environment will be used in this project. Participants will engage in active learning through activities that utilize active learning strategies: participatory and peer-learning, reflective learning, discovery learning, and distance mentoring.
- **Positive learning attitude**
In all six phases, participants will be exposed to cooperative and supportive attitudes toward learning. It is expected that the participants will adopt this attitude in their educational practices.
- **Learning through best practices**
The participants will be expected to critically evaluate how TIEE is conducted as it presents a learning model for them. Through modeling the best practices presented in TIEE, participants will have the opportunity to experience how learning theories and research-based interventions are applied in a real educational setting.
- **Innovation that is sustainable**
Well-designed action plans at the individual and institutional level will be required for selected qualified participants. These action plans must be implemented and evaluated to ensure the quality and sustainability of the innovation efforts within the participants' individual institutions as well as disseminating them to other institutions.

Six phases of TIEE

TIEE is a learning forum that is designed and delivered in six phases (see figure on page 5) over a 1½-year time period.

- **Phase 1: Discover and Document** (Virtual Meeting – 4 weeks)
Each participant has the opportunity to identify his or her teaching style and reflect upon teaching experiences. Reading materials that help participants to reflect on their individual core educational beliefs will be used during this phase. Engaging in this exercise will aid participants in preparing for phase 2 in which they will analyze theories, and gain input and ideas from others. The expected outcome of this phase is the opportunity to assess educational beliefs using educational evaluation techniques.
- **Phase 2: Explore and Plan** (Face-to-Face Meeting – 2 weeks)
The participants and resource persons meet face-to-face for the first time. Learning materials will be delivered using a participatory learning strategy that requires participants to discuss, share, and reflect on, and rediscover their understanding and beliefs about teaching and learning. Research-based material as well as personal experience in engineering teaching practices will be called upon. Topics of discussion will include, but not be limited to, cognition and expertise, learning theories, curriculum

development, learning assessment, problem-solving and instructional technology, presentation techniques, and research topics in engineering education.

Before finishing this phase, each participant will be invited to prepare a new teaching plan. The plan should be associated with one course that he or she plans to teach in the next year, and should include new ideas learned during previous phases and be doable within the following months. The expected outcome of this phase is new knowledge and teaching skills in teaching engineering.

- **Phase 3: Execute and Evaluate** (Distance Mentoring – 20 weeks)

All teaching plans are executed during this phase. Each participant will work in a group and mentors will be assigned to each group. Regular virtual meetings will be conducted via Internet-based media where group members and their mentors discuss and solve any problems that the group members may face while implementing their plan. The virtual communication may be conducted both asynchronously and synchronously.

The objectives of the distance mentoring are to ensure that participants stay on task in their teaching plan, fulfill the milestones stated in their action plan, and be successful. Before finishing this phase, each group will prepare their group presentation for phase 4. This group presentation should reflect the dynamics and accomplishments of their experience during phase 3. Each participant will be required to prepare a poster presentation which describes individual accomplishments and future teaching developments. The expected outcome of this phase is the experience of developing and implementing innovative teaching strategies that are suitable to each participant's teaching course. Each participant will also practice their newly developed lessons and methods in front of students and will be observed and evaluated using Rating Teacher Observation Protocol (RTOP). RTOP is a validated observation instrument that is used to consistently evaluate teacher teaching in their classroom environment.

- **Phase 4: Share the Plan** (Face-to-Face Meeting – 1 week)

In this phase, each participant has the opportunity to share personal accomplishments and group activities during phase 3 with other participants and mentors, and be recognized for their accomplishments. Awards will be given for the best group presenter and individual poster presentation. The expected outcome of this phase is self-confidence to design and implement innovative teaching strategies in engineering education.

- **Phase 5: Develop and Strategize** (Distance Mentoring – 16 weeks)

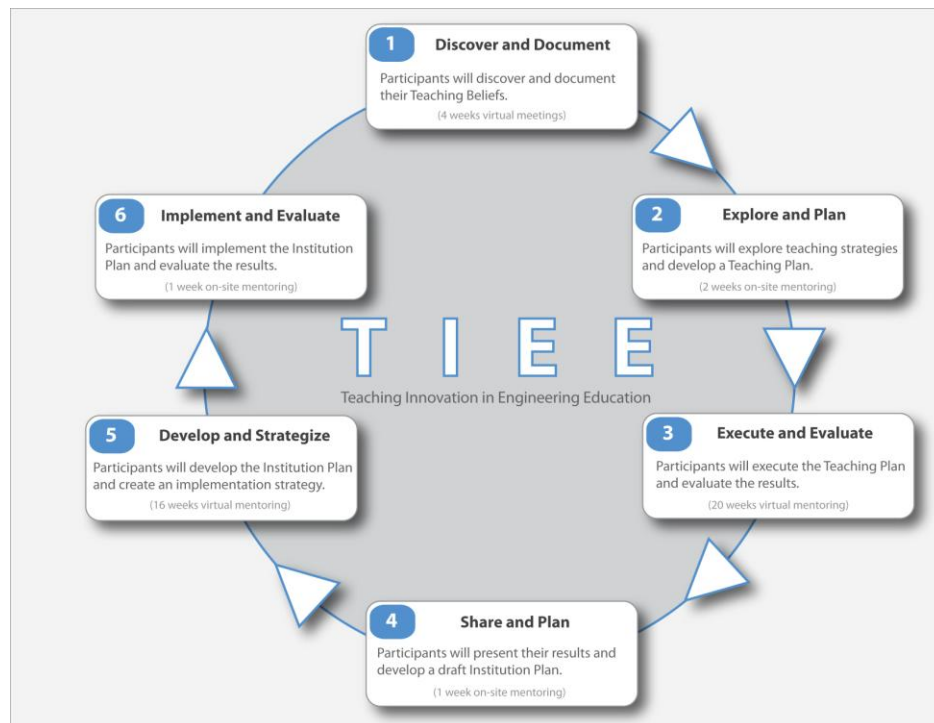
Institutional change occurs when best practices that were once new become integrated into the department, college, or university structure and routine. During this phase, all participants, individually or as a group, will be asked to think, discuss, and make a plan that can help their institutions promote teaching innovation on a larger scale.

Each participant will identify at least one individual that does not participate in TIEE to be included in the plan, which should be manageable and doable within the participant's ability. The scale of the institutionalized effort is open. The plan could be implemented at the department, college, or university levels. They can also plan to work collaboratively with their colleagues at other institutions.

All plans must be negotiated and approved by the relevant supervisor. Without proper acknowledgment from the supervisor of the affected work unit, the plan will not be accepted and therefore, cannot be executed. This process as well as the approval must be included at the proposal stage. The expected outcome of this phase is a concrete plan to facilitate the implementation of teaching innovation at the organizational level.

- **Phase 6: Implement and Evaluate (29 weeks)**

During this phase, participants are expected to implement their institution's plan. Depending upon the scale and the length of the project, site visits will be conducted to assess the quality of the implementation of the plan. Best practices shown by the participants will be recognized, and participants will be invited to visit Utah State University (USU). A certificate of completion will be awarded to each participant. The expected outcome of this phase is the creation of a wider community that promotes innovative teaching in engineering education.



Sustainability

The sustainability of this project will be ensured through the following activities:

1. Successful development, implementation, and evaluation of the teaching plan conducted during phase 3 will enable each participant to reflect and revise his or her future teaching strategies. Skills gained will insure that the participants become better teachers.
2. Successful design and implementation of the institution plan conducted during phases 5 and 6 will benefit participants' teaching institutions. Collaborative effort to work on activities similar to TIEE is strongly encouraged among the four partner institutions after USAID funding. Utah State University (USU) offers its continuous support to the partner institutions by giving expertise and access to all of the materials used in this project.

3. Collaboration among universities in Indonesia has been established through various programs at the national level such as Inherent (Indonesian higher education network), and at the institution level, such as Center for Learning Resources (CLR) atau Pusat Pengembangan Sumberdaya Pembelajaran (PPSP) at Universitas Indonesia, Pusat Pengembangan Pendidikan dan Aktifitas Instructional (P3AI) at Institut Teknologi Sepuluh Nopember, and Pusat Pengembangan Pendidikan (P3) at Universitas Gadjah Mada. Through these existing networks, this TIEE initiative can be developed beyond the USAID funding.
4. Future Research and Development Projects
This project will prepare each participant to seek national funding in the area of education reform. Through the TIEE learning model, each participant has the capability to disseminate knowledge, skills, and strategies to a wider community in Indonesia.

Beneficiaries

The outcomes resulting from TIEE will benefit the following parties:

1. *Participants*. Sixty teaching engineering faculty members from four partner institutions representing various regions in Indonesia will have been exposed to new teaching strategies, and thirty of them will have the experience to test and evaluate their teaching innovation. Moreover, they will also have had the experience to institutionalize their knowledge and skills in innovative teaching.
2. *Engineering students in Indonesia*. Engineering students participating in classes taught by TIEE participants will benefit from their teacher's innovative teaching strategies.
3. *Institutions*. Both the Indonesian institutions and Utah State University will benefit from having a larger role in disseminating their teaching faculty members' accomplishments to other institutions in their regions. Institut Teknologi Sepuluh Nopember in Surabaya and Universitas Hasanuddin in Makassar, for example, will play an important role in promoting continuous innovation in teaching to many other institutions eastern Indonesia. As one of the three institutions in the United States that offers a PhD in Engineering Education, this project will enable USU to open new avenues of academic collaboration with partner institutions and other institutions in Indonesia.

Expected Results

Upon successful completion of this project:

1. At least 30 teaching faculty members from Universitas Indonesia, Universitas Gadjah Mada, Institut Teknologi Sepuluh Nopember, and Universitas Hasanuddin will have the capacity and experience to deliver innovative teaching activities.
2. There will be at least 30 highly knowledgeable and skilled engineering teaching faculties that have the experience to develop and deliver an institution plan to advocate and facilitate teaching innovation within and outside their own institution.
3. Teaching improvement activities will be continuously conducted by all benefited participants and institutions.
4. Collaborative teaching development and research activities in engineering education between the lead institution and partner institutions will have been established. Currently, the Department of Engineering and Technology Education at USU has offered an assistantship to one PhD student from Indonesia and would like to invite more qualified students from Indonesia to pursue a PhD or participate in sandwich program as well as faculty members to do their post-doctoral research in Engineering Education.

Partners Profile

Five academic and research institutions will collaborate on the proposed partnership. A brief detail about those institutions is described in the following:

Utah State University (Lead Institution)

Since its founding in 1888, Utah State University (USU) has evolved from a small, agricultural college to one that is nationally and internationally recognized for its intellectual and technological leadership in land, water, space, and life enhancement. As a land- and space-grant institution, the university provides education for more than 23,000 undergraduate and graduate students. The main campus includes 47 departments in 7 academic colleges, a School of Graduate Studies, University Extension, and several research programs. In addition, the university includes 3 regional campuses, 2 institutional partnerships, and 15 Education Centers located throughout the state of Utah.

The Department of Engineering and Technology Education (ETE) is in the College of Engineering. It offers three degrees in the subject area of Engineering and Technology Education: a bachelor and master of science in Engineering and Technology Education and a doctor of philosophy in Engineering Education. The department is one of three in the United States that offers a PhD in Engineering Education. The department also houses the National Center for Engineering and Technology Education (NCETE). The center represents a partnership between nine universities throughout the United States.

A major contributor assisting the university's mission is the Faculty Assistance Center for Teaching (FACT) lab, which is one of the premiere instructional design teams operating in higher education. It is a recognized leader in design and accessibility innovations in the Learning Management System that USU uses to deliver hundreds of online courses. FACT is committed to supporting the university community and empowering faculty to improve the quality of instruction.

Universitas Indonesia (Partner institution)

The Universitas Indonesia is one of the oldest and most prestigious institutions in Indonesia. It has more than 30,000 undergraduate and graduate students studying within its 13 faculties. It was recently ranked in the top 50 Asian Universities in the 2009 QS-Times Higher Education Asian University rankings. It plays an active role in various higher learning associations, including the Association of Pacific Rim Universities (APRU), Association of South East Asia Institution of Higher Learning (ASAIHL), and the ASEAN University Network (AUN).

The Faculty of Computer Science comprises one of the premiere learning and research institutions in developing computer science and information technology in Indonesia. Starting in 1986, it now offers undergraduate, master's, and doctoral degrees in computer science and information systems. Since 2002, it has established a dual degree Bachelor of Information Technology program with the University of Queensland. In 1997, the Faculty was the first-ranked recipient of the World Bank-funded competitive grant of \$2 million, to improve the quality of undergraduate education. Currently, the faculty houses approximately 1,000 students and is supported by 50 faculty members, including 23 PhD faculties.

The Faculty of Engineering consists of seven departments: Civil, Machine & Marine (Ship), Electrical, Metallurgical & Material, Architectural, Chemical, and Industrial Engineering. It

offers undergraduate, master's, and doctoral program degrees, with 31 full-time and 7 clinical professors.

Universitas Gadjah Mada (Partner institution)

Universitas Gadjah Mada (UGM), which has taken on a new status as a state-owned legal entity since 2000, is the oldest and largest university in Indonesia. It was founded in 1949 and currently has 18 faculties, 71 undergraduate study programs, 28 diploma study programs, and a graduate program of 62 study programs with 55,000 students, 350 foreign students, 2,301 employees, and 2,266 lecturers. The UGM is located in Yogyakarta, once the old capital of Indonesia.

One of the largest faculty at UGM is the Faculty of Engineering, consisting of eight departments: Architecture and Planning, Electrical, Engineering Physics, Geodetic & Geomatic, Geological, Chemical, Mechanical & Industrial, and Civil and Environmental Engineering. The Faculty of Engineering has an academic staff of 434 and 12,666 undergraduate and graduate students.

Since 2003, UGM has actively promoted Student Centered Learning (SCL) methodology to all academic staffs. Workshops have been conducted to guide in the implementation of SCL. In 2004, UGM established a university-wide e-learning system (LMS) called eLisa (eLearning System for Academic Communities). It is now used by 5,457 teaching teams, 67,905 users and hosts about 1,148 learning communities. By using eLisa, UGM can host many courses that can be accessed by Indonesian peoples for improvement of knowledge.

Institut Teknologi Sepuluh Nopember (Partner institution)

Occupying a large area totaling 180 hectares at its main campus in Sukolilo, an area in the vicinity of East Surabaya, East Java, Indonesia, not only does ITS provide advantages for both excellent scientific activities and a pleasant natural life environment, but it also has a friendly atmosphere and an enormous community spirit. In addition to the main campus, the Cokroaminoto campus is the location of the Graduate Program in Management, ITS Language and Cultural Center, and some collaborative institutions.

Currently, ITS has a wide range of degree and nondegree programs that are managed under five faculties: Mathematics and Natural Sciences, Industrial Technology, Civil Engineering and Planning, Marine Technology, and Information Technology. In addition, two polytechnics operate under the Institute's management, i.e., Electronic State Polytechnics and Shipbuilding State Polytechnics. The ITS offers 76 courses in 9 doctorate programs (S-3), 15 masters' programs (S-2), 22 undergraduate programs (S-1), 6 programs of a 3-year diploma (D-3) under the Faculty of Industrial Technology and Faculty of Civil Engineering and Planning, 4 programs of a 4-year diploma of polytechnic (D-4), and 8 programs of a 3-year diploma of polytechnic

Universitas Hasanuddin (Partner institution)

The Universitas Hasanuddin (Unhas) is the oldest and largest university in region of Eastern Indonesia. Founded in the 1960s, the vision of Unhas is to become the Center for Development of Maritime Culture that aims to explore and revive the values of maritime cultures - namely self-sufficiency, unflinching determination, adherence to core principles, interconnectivity and holism. Its missions are: (1) to produce independent alumni of good character and with a global vision, (2) to develop science and technology related to the management of resources, and (3) to promote and encourage the realization of maritime values in the society.

Currently, Unhas has approximately 23,000 students in its bachelor, master's, and doctoral programs. The campus was designed to accommodate 15,000 students. The Faculty of Engineering at Unhas consists of six departments: Civil, Mechanical, Electrical, Ship, Geological and Architecture Engineering.

Administrative Capabilities

Utah State University (USU) has access to extensive U.S. Resources such as the Applied Technology Centers (ATC), which have vocational skills development programs, diagnostic tools, modularized curriculum, and skills development programs, diagnostic tools, modularized curriculum, and skills certifications; the State of Utah Department of Education which has developed skills analysis tools and management information systems that are used nationwide (and in many cases worldwide); the Utah Manufacturing Extension Partnership (Utah MEP) which is part of a nationwide manufacturing extension program. USU will draw upon these resources as needed for this project. USU and the Department of Engineering and Technology Education has been successful with many international projects. Projects range from vocational training; primary, secondary, and higher education; curriculum development; instructor training; education planning; management information systems; teaching materials educational technology; formal and informal in-service training; skills assessment and certification; and methodologies for strengthening in-country institutions.

Included below is a list of projects from USAID, ADB, and WBI:

Dr. Kurt Becker has 15 years' experience working on international partnership projects, including the Asian Development Project (ADB) Loan No. 1494-THA Thailand Skills Development Project, Bangkok, Thailand in delivering technical training to vocational training institutions throughout Thailand, and Vocational Training Project - Project Preparatory Technical Assistance to Bangladesh. In addition, he has **worked on USAID project in workforce development.** These projects consisted of enterprise competitiveness training in Poland working with the with the Ministry of Labour and National Employment Service in Katowice, Poland to (1) create a central training model using the Quick Start training method, (2) development and delivery of a Train-the-Trainer course for the workforce Development Project in Poland, and (3) assist with Quick Start training for task analysis and working with local governments (in-country) to assist in retraining efforts.

Dr. Lawanto has 4 years' experience working collaboratively with World Bank Institute (WBI), a subsidiary of the World Bank, in several international workshops associated with Improving Training Quality (ITQ) for numerous countries. He also chaired in a WBI workshop in *Enhancing Training Quality through Customer Service (QCS-1)* in Bali, Indonesia. He conducted similar ITQ workshops with universities and high school teachers in Indonesia.

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No	Cost Line Items	USAID \$ Amount	Cost Sharing	Project \$ Amount
A	Resource Person			
	• Utah State University - USU (A1)	75,000	30,000	105,000
	• Partner Institutions (A2)	30,000	2,500	32,500
B	Consultant			
	• University of Illinois at Urbana-Champaign	17,000	0	17,000
C	Stipend for TIEE Participants	19,500	15,000	34,500
D	Travel			
	• International Plane Ticket (D1)	36,000	0	36,000
	• Domestic Plane Ticket (D2)	27,000	0	27,000
	• Accommodation (D3)			
	- In Indonesia	46,000	0	46,000
	- In USA (Logan)	1,920	0	1,920
E	Meals			
	- In Indonesia	28,750	0	28,750
	- In USA (Logan)	720	0	720
F	Ground Transportation	3,110	0	3,110
G	Graduate Students			
	• Tuition & Fees (G1)	0	54,000	54,000
	• Stipend (G2)	49,500	0	49,500
H	Certificates and Souvenirs	500	0	500
I	Sub Contractor (FACT Center USU)	50,000	0	50,000
J	Facilities			
	• Utah State University		23,500	23,500
	• Partner Institutions		70,000	70,000
*	Total Cost before Overhead	385,000	195,000	580,000
*	USU Overhead Cost: 40%	207,000		207,000
*	USU Administrative International Fee: 10%	58,000		58,000
	Total Cost Includes Overhead Cost	650,000		845,000

	: Utah State University Cost Sharing
	: Indonesian Partner Institution Cost Sharing

BUDGET JUSTIFICATION:

A. *Resource person* consists of 3 persons from USU and 4 persons from Indonesian partner institutions (including administrative persons from partner institutions).

B. *Consultant* (1 person) works to support TIEE by giving consultation to project team member.

C. *Stipends* for 60 participants in phase 1 and 30 participants in the last phase.

D. *International Flights* for 4 U.S. resource persons and 4 selected (best) participants; *Domestic Flights* for resource persons from partner institutions, participants (including review activities to the four partner institutions); *Accommodation* is provided for all resource persons and participants.

E. *Meals* are provided for all resource persons and participants.

F. *Ground transportation* while conducting the program in Indonesia.

G. *Tuition, Fee, and Stipend* for 1 PhD student in 3 years of study.

H. *Certificates and Souvenirs* given to all participants who attend the program.

I. *Subcontractor* for providing ICT facilities to support the program (distance mentoring activities)

J. *Facilities* used to support the program are provided by both Utah State University and Indonesian partner institutions.