Results of the ABET
Information Technology Colloquium

January 2003

RESULTS OF THE ABET INFORMATION TECHNOLOGY COLLOQUIUM

BACKGROUND

In May 2002, ABET, Inc. sought and was awarded a grant from the National Science Foundation to assemble a group of experts from academe, industry, and government, with the goal of defining the attributes of a graduate of a college or university baccalaureate program in information technology.

There are differing definitions of information technology, and representatives of these groups were invited to a January 2003 meeting at the National Academies to determine a common ground for preparing students to enter the field of information technology. ABET believes that determining the attributes desired in the graduate will provide a sound basis for developing appropriate curricula in colleges and universities.

DEFINING THE PROBLEM

A new proliferation of academic programs and disciplines in the computing sciences that employ variations of the terms 'information' and 'technology' has resulted in confusion and ambiguity for those who have a need to educate students in and hire employees with specific skill sets.

According to the Information Technology Association of America (ITAA), a trade association representing 11,000 companies, estimates of the number of information technology workers in the United States range from 4 to 14 million, depending upon how they are counted: 'BIG IT" workers, such as bank tellers, or 'little it' workers, those who work with computer-based systems.

Educational institutions, reacting to the nearly $3 trillion global information technology marketplace, are racing to fill the need by creating a multiplicity of information technology degree programs, many of them with little or no connection to each other. This raises the additional question of how to educate and train prospective workers: just which technology skills, to what depth, and what 'soft' interpersonal skills such as communications, teamwork, and business acumen are needed? At what levels are these technical and interpersonal skills required?

OUTLINING THE STRATEGY

In June 2002, ABET President Jerry Yeargan presided over the first meeting of the Information Technology Convening Committee, whose members included ABET volunteers Ted Bickart, Gerry Engel, and Lyle Feisel, as well as Doris Lidtke and other ABET staff. The committee's charge was to begin to proactively develop a structure, process, procedures, and criteria for information technology and similarly named programs.

Realizing the scope of the task, committee members pooled their knowledge of experts in the field and those with an interest in resolution of the problem. Because of budgetary constraints, an invitation-only policy prevailed for the colloquium.

INVITED PARTICIPANTS

Nearly all of the more than 40 invitees, whose numbers included those from across the information technology spectrum – developers and users – enthusiastically accepted. They included (in some cases, multiple) representatives of the following organizations:

ABET, Inc.	University of Massachusetts	NSF/CISE
Indiana University	Computer Research Association	Colorado School of Mining
AACSB	British Computing Society	Rock Valley College
Iowa State	Villanova University	IBM
CSAB	IEEE	George Mason University
Siemens AG	Microsoft	Northeastern University
Drexel University	University of Washington	University of Pittsburgh
NAE/CSEE	National Science Foundation	Ramtech
MIT	Southern New Hampshire Univ.	Hewlett-Packard
AOL/Time-Warner	Georgia Southern University	Stanford University
NWCET	Syracuse University	NASA
RIT	Info. Tech. Assoc. of America	University of Arkansas
ACM		

In some cases, those originally invited suggested more appropriate substitutions, or made suggestions for additional participants. The attendees were selected to represent as many facets of the computing community as possible, with a concerted effort to include members of the information technology community.

The group included five members of the CRA IT Deans group; representatives from the ACM and IEEE-CS education boards; representatives from the National Science Foundation; representatives from all four ABET commissions; and ABET volunteers and staff.

OBJECTIVES OF THE COLLOQUIUM

The colloquium was planned with the goal of producing these outcomes: a common ground for preparing students to enter the field of information technology, and a sound basis for developing appropriate curricula in colleges and universities. The plan is to eventually use the results of this initiative to build a foundation and formulate a process for the accreditation of information technology and similarly named programs.

COLLOQUIUM STRUCTURE

The colloquium convening committee felt that providing ample opportunity for discussion among attendees was paramount; thus, the agenda was structured in such a way to facilitate this.

The Medical Profession Construct

To provide a framework for the colloquium, planners discussed possibilities for presentation of alternative views or ways of thinking that might provide a fresh perspective to the group. The convening committee decided to seek a representative of a profession that had experienced a similar debate. The speaker would give remarks at a reception on the evening prior to the start of the colloquium.
Medicine was determined to represent a profession that also has a "big/little" construct. The medical profession has wrestled with the issues of new, emerging specialties in the field, and the blurring of boundaries among disciplines and sub-disciplines. The spectrum of medical professionals ranges from health technicians and nurses, to general practitioners and specialists. This blurring of boundaries among disciplines, and the varying levels of education and training required for medical professionals, is not unlike what is happening the information technology world.

To explain the construct, which might serve as a successful example for information technology, the committee invited David Stevens, MD, Vice President for Medical School Standards and Assessment, Association of American Medical Colleges (AAMC), and member of the Institute of Medicine. Dr. Stevens also serves as AAMC Secretary of the Liaison Committee on Medical Education, the accrediting body for medical schools in the United States and Canada.

Using as an example the four-year medical school education, which culminates in obtaining the MD degree, Dr. Stevens explained that years one and two are generally devoted to the basic sciences. Year three provides the first clinical experience, with rotations throughout a hospital's departments to learn as much about each field as possible. The fourth year allows the student flexibility to take electives for areas in which he or she is interested.

Upon graduation, the newly minted physician is – save for a licensing exam – technically capable of going into the community as a general practitioner. The specialist-technologist revolution of the late 1800's ushered in the paradigm that still exists (having exploded in the 1960's): the continued education and training of varying lengths of time and degree of difficulty for ever-increasing numbers of specialties. The Accreditation Council for Graduate Medical Education has oversight for the curriculum, academic standards, and evaluation criteria for graduate medical education.

"Why We're Here"

Following Stevens, ABET Executive Director George D. Peterson, Ph.D., P.E., spoke, explaining why ABET elected to take a leadership role in this initiative:

- ABET's Board of Directors has stated as one of the strategic issues requiring its immediate attention: "Emerging technologies, changing disciplines, and the blurring of boundaries among technological disciplines challenge traditional approached to educational delivery and assessment";
- This proliferation of new programs and professions create expectation that accreditation will be readily available;
- Multi-disciplinary educational approaches linked to an application, industry, service, or product challenge assignment of programs within traditional ABET structure;

- Distinct program criteria will be increasingly impractical;
- Program assignment within ABET commissions will become more difficult;
- Increased specialization within technological disciplines makes it difficult for ABET to identify a common core of knowledge for applied science, computing, engineering, and technology;
- The number of information technology programs will only continue to grow;
- Students, parents, educators, industry, the public and others deserve clarification/direction.

Finally, ABET already has received numerous requests to accredit programs relating to information technology; therefore, it was appropriate and timely that ABET take next steps.

Peterson also explained the perspective from which the issue would be examined: Information Technology ("Big IT") is an umbrella, under which exists such disciplines as computer science, software engineering, management information systems, computer engineering, information systems, telecommunications and networking, and information technology ("little it"). The colloquium would deal specifically with those issues related to "little" information technology,

Colloquium Agenda

As previously stated, planners felt that ample time should be assigned to group breakout sessions. To provide the basis for discussion, the convening committee devised a 'preamble' that provided context to the meeting, along with an attendant set of questions for reflection and review. The preamble read as follows:

"The purpose of this meeting is to assemble a group of experts from industry, government, and academia to attempt to define the attributes of a graduate of a college or university degree program in information technology. There are differing definitions of information technology, and representatives from these sectors are being brought together to determine a common ground for preparing students to enter the field of information technology.

This meeting focuses on the determination of the attributes of the graduate of an information technology degree program. These attributes will provide ABET with a sound basis for developing the criteria for the evaluation of information technology programs, and will provide colleges and universities with guidance for developing appropriate curricula.

Information Technology encompasses a broad spectrum that includes Computer Science, Information Systems, Computer Engineering, Software Engineering, and the like. *This meeting examines information technology from the perspective of graduates of information technology degree programs, at the baccalaureate level*.

Prior to the Meeting

Attendees were provided with the following questions prior to the meeting, with the request that they be prepared to share their thoughts on them:

1) From your perspective, what issues do you believe are driving the need for graduates of information technology programs?
2) If you are from industry, how do these issues affect you? Alternatively, if you are from a college or university, how do these issues affect you? Which issues require immediate attention?
3) What do you perceive are the attributes that a graduate of an information technology degree program should possess for successful entry into the workforce?

Additionally, three speakers representing different sectors (industry, academe, employer, association) were asked to summarize their perspectives in a one to one and one-half page white paper, provided to attendees as pre-reads. Each breakout session would be preceded by a speaker, whose thoughts would provide the impetus for a question and answer response, and a segue into the subsequent session.

Speakers and Topics

Speakers and their topics included:

- Joel Moses, Institute Professor, Engineering Systems Division, Massachusetts Institute of Technology (MIT), Insights from the Academic Perspective

(Excerpt: "I believe that information technology is the mathematics of the 21st century, and may undergo a development in academia over the coming decades similar to the one that has been undertaken by pure and applied mathematics over the past two centuries. One idea is to create courses that provide a growing understanding of information technology with levels that can be described as literacy, fluency, and competency.")

- Kruno A. Hernaut, Siemens AG, Germany, Insights from the International/Industry Perspective

(Excerpt: "Information technology graduates need a solid foundation in technical skills from both the engineering and informatics cultures, with a particular emphasis on a broad systems perspective. They need training in team working, with real experience of team projects where several activities are undertaken in parallel. They also need a basic understanding of economics, market, and business issues. In addition, information technology graduates need to have good personal skills such as problem-solving abilities, awareness of the need for lifelong learning, readiness to understand fully the needs of the customer and their project colleagues, and awareness of cultural differences when acting in a global environment.")

- Marjorie Bynum, Vice President, Workforce Development, Information Technology Association of America (ITAA), Insights from the Employer/Association Perspective

(Excerpt: "Another important issue impacting industry is how colleges and universities keep up with the rapid pace of change for information technology skills, and how these institutions continue to create value for employers seeking the best talent. Part of creating this value lies in examining the overall mission of information technology education. Another interesting challenge is how to rationalize and sift through the confusing maze of multiple information technology degree programs. Although numerous programs exist that students can choose from, there seems to be little or no connection between them. A more cohesive approach to information technology education is needed to help students and businesses better understand the value of various degrees and how they relate to each other.")

Welcoming remarks were provided by Bill Wulf, President, National Academy of Engineering, and Jerry Yeargan, ABET Past President, University of Arkansas, reiterated for the group the focus of the colloquium.

At the conclusion of the opening remarks, strategist Jim Dalton introduced the workshop process, noting that the questions (listed above) distributed prior to the meeting had been refined to elicit more specific responses. He explained the colloquium's planned structure as follows:

Day 1:

Q&A Response to Talking Paper – Joel Moses, MIT

Facilitated Breakout Session: What are the critical issues driving the discussion?

Q&A Response to Talking Paper – Kruno Hernaut, Siemens AG

Facilitated Breakout Session: How is the target population defined, in terms of the functions they perform?

Reports on Breakout Sessions

Day 2:

Strategy Update – Jim Dalton

Q&A Response to Talking Paper – Marjorie Bynum, ITAA

Facilitated Breakout Session: What are the desired attributes of an information technology graduate?

Reports on Breakout Sessions

Strategy Summary – Jim Dalton

Plenary Session: What's next?

Members of the convening committee (Ted Bickart, Jerry Engel, Lyle Feisel, Doris Lidtke) served as facilitators at the breakout sessions.

RESULTS OF THE COLLOQUIUM

With the assistance of these facilitators, attendees debated four fundamental questions.

1) What are the critical issues driving this discussion?

The following twelve issues were refined from a longer list that was developed by four working groups:

1. Establishing a common understanding of information technology carries a sense of urgency because:
   a. Change in information technologies are advancing rapidly;
   b. Information technology is in the formative stages of development as an emerging and distinct discipline;
   c. There are increasingly wide variations in curricula content and quality;
   d. Job functions that use the term are becoming increasingly diverse.

2. The lack of agreement on the definition of information technology creates confusion for students, complicates the employer's search for people the most qualified to address their needs, and makes it difficult for associate degree programs to prepare transfer students.

3. The absence of a widely accepted intellectual foundation leaves information technology without the basis for a recognized discipline and puts it at risk of being defined by current technologies.

4. High demand for information technology graduates in the absence of generally accepted quality standards makes it difficult to scrutinize education providers of questionable quality.

5. Lack of clarity in the definitions of, and relationships among the other "Big IT" disciplines confuses the clients and compounds the difficulties associated with any attempt to accredit the "little it".

6. Traditional/classic/pure programs produce graduates that are not taught to deal with core organizational processes or the management of large systems.

7. Lack of academic respect/power/opportunity for information technology-oriented faculty in some programs gives energy to the drive for separate information technology departments.

8.   Many programs want the recognition for meeting quality standards that is conveyed by accreditation.

9.   The pursuit of a degree based on competencies aimed at long-term career growth is challenged by:
       a.   Employer demand for temporal, measurable specialty skills;
       b.   Financial incentives for students to short cut their formal education.

10.   The inherent nature of information technology involves the development of new pedagogies and methods of instruction.

11.   The disruptive impact that information technologies have on social structures and economic assumptions puts increasing pressure on information technology graduates to have the leadership abilities to deal with these socioeconomic transformations.

Summary: the lack of a common definition of information technology is a major problem, one that has been exacerbated by the wide use of the term by industry, government, and academia. The wide usage of a term that is ill-defined leads to confusion: business does not know what to expect from an information technology graduate; institutions develop programs to produce information technology graduates, but there is no agreed-upon body of knowledge or theoretic foundation for the field; and programs often fail to receive recognition or respect within the institution. Students and their parents are not sure what an information technology program is, and are unsure how to identify a quality program. Continuing rapid change of the technology only further complicates the problem. Some concern was expressed by attendees about premature standardization of the body of knowledge, or clearly defining how information technology differs from CE, SE, CS, IS, and other computing degrees.

2)   How should the 'little it' population be defined, in terms of job functions?

Representative breakout group responses are shown below:

Group A: information technology support and services, applications design, strategic planning and management
Group B: information system planning, customer problem solving, systems analysis, database design, testing, systems integration
Group C: integration, maintenance, administration and management, recommending technology
Group D: content, information management, information technology, core competencies, soft skills and theory

Summary: there is a plethora of different job functions that a graduate of an information technology program should be aware of and able to handle. While there is not complete agreement on the job functions, there is agreement that multiple dimensions of knowledge are needed. Domain, management, organizational, and technical knowledge are essential. Personal skills, including communications skills,

the ability to work with people, an understanding of other cultures and groups (internal and external), were deemed essential.

There was reasonably high agreement on the specific technical skills needed and a recommendation to look at previously developed skill standards in the information technology area. Some of the specific standards that should be reviewed include:
IFIP, NWCET, SMRC, Career-Space, BCS, E-skills, SEARCC, and industry standards set by companies such as Microsoft and Oracle.

3)   What are the desired attributes of the information technology graduate?

Representative group breakout responses are shown below:

Group A: ability to apply knowledge and skills, ability to succeed, promote-ability
Group B: work in teams, diagnose and solve complex information technology problems, continuously refresh and extend professional skills and knowledge
Group C: information technology support and services, strategic planning and management, application design, informatics, technical skills, human skills
Group D: ability to use and apply current information technology theory, concepts, and practices, collaborate in multidisciplinary teams, demonstrate critical thinking and problem solving

Summary: while the breakout groups used different organizations and words, common attributes of an information technology graduate shared by the four groups included, in no particular order:

a. Use and apply current information technology theory, concepts, and practices;
b. Analyze, identify, and define user requirements;
c. Effectively develop, define, document, test, and maintain information technology-based solutions;
d. Integrate solutions into the user environment successfully;
e. Perform appropriate tasks of project management;
f. Integrate appropriate business practices into solutions;
g. Identify and quantify emerging technologies;
h. Analyze impacts of technology with regard to legal, social, ethical, global, safety, and security risk issues;
i. Demonstrate critical thinking and problem solving;
j. Collaborate, especially in multi-disciplinary teams;
k. Recognize and integrate opportunities for lifelong learning;
l. Communicate across a range of audiences and constituencies;
m. Use appropriate tools to maintain a positive outlook in the face of adversity.

4) Should ABET move toward accreditation of information technology programs?

If yes, why? What issues need to be addressed before developing criteria?

If no, why? Not needed: Ever? Why? What other steps need to be taken first?

Unlike the previous three questions, the above was put to the entire group, rather than breakout groups.

The following provides summary statements of the comments made in the session that addressed the fourth and final question, which elicited a response from most attendees:

1. We are a regional university and accreditation would have value in that it provides a quality standard.
2. Our school is working with a consortium to develop an online program and accreditation; even the effort to accredit would give us some parameters to go by.
3. I am in favor of accrediting information technology programs, but am concerned about ABET having a growing number of related silos [separately defined subdisciplines] in this area.
4. Most of the academic programs on our campus are accredited and the fact that we are not brings a certain loss to our standing.
5. Accreditation helps us develop/attract resources.
6. I favor moving to accredit information technology only if the effort takes full advantage of the fact that we would be building it from a fresh start, around a new discipline, as opposed to the more common situation where the effort is attempting a conversion from an old way of doing things, where people are fixed and everything is a compromise. This is a very creative opportunity, if done right.
7. We need a more thoughtful process that helps programs improve quality on a continuing basis, not just prior to the accreditation visit.
8. I have concerns about moving to accredit at this time. It is premature to start working on a standard, given the still-formative stages of an emerging discipline. We are seeing very diverse programs out there, and the accreditation standards would move programs toward homogenization. It is still too early in the evolutionary process to accredit.
9. All of the descriptions made of information technology at this meeting do not begin to describe our program and that concerns me.
10. I share this concern. Information technology is too big to get our hands around now, and accreditation will make it too narrow, too soon. It needs to develop on its own for a while.
11. All the reasons given at this meeting for accrediting information technology today will apply to many more upstarts on the horizon and that future looks cluttered and unreasonable. Accrediting information technology is loaded with the prospect of accrediting an endless stream of related specialties.
12. Gearing up an effort of this size cannot be made to apply to all of the programs that are out there. The diversity is too great. However, if we focus on the outcomes with wide tolerance for the variations in the many ways those outcomes can be achieved, it is less daunting.

13. It is clear we cannot focus on curriculum and lock into sets of courses, which is a mistake that has been made in the past. It must be outcomes based.
14. We need more confidence that, like librarians, this field can develop one accreditation program can address this multiplicity of options.
15. I disagree with the librarian analogy because they are much more geared to self-study in a way that accommodates that single, broad-based model.
16. BCS in Britain has a single accreditation system used to address a very broad spectrum of information technology-related programs – proof that it can be done.
17. If ABET can do for information technology what software development did in focusing on processes, then I would support the effort; however, it must be process-oriented.
18. The "little it" concept has thrown us off because we are looking too closely at a narrow aspect of what is an inherently broad endeavor, seamless in its relationship to the larger context in which is operates.
19. This situation called for a new and more creative approach than ABET is currently positioned to see and pursue.
20. It is clear from a number of the remarks made here that many at this conference do not know how much ABET has changed its approach in recent years.
21. Yes, I support it because someone is going to do it soon, and there ABET should take the lead now.
22. I support ABET moving on this but am concerned about the prospect of working on criteria too soon. Much more needs to be done in networking with other organizations to get industry-wide agreement on what is needed and then to explore alternative means of doing it.
23. My test is I want to see a single model, "multi-flavored" approach that some have referred to.
24. I think we should forget all of the practical, doable problems and create a vision of an ideal model in a perfect world. Forget the constraints. This is an intelligent, prosperous community. Let's get a vision and then deal with the problem.
25. We need to investigate the programs that do a high quality job of what they claim to do.
26. We should move faster rather than slower. We need to include industry more than in the past. If we capture the value of industry's increasing ability to understand and enable the long-promised "knowledge worker," we will be on the right track.
27. China and India are redefining information technology very fast and they need to be a part of this effort. It should be global in perspective.
28. The effort must include many more organizations than the traditional approach.
29. Those who say wait or go slow must address the consequences of not acting. There are adverse impacts of not acting.
30. Research universities will need a clearer answer to the question of what is in it for them.
31. Information technology service organizations are underrepresented in these discussions and need to be involved in them – this includes government as well.
32. Be aware of the fact that we might not have the right players at this point; we need to make a more comprehensive assessment of who should be involved.
33. We should conduct focus groups with high school students and their parents to see if we are defining career paths they can understand.
34. With all due respect to the many issues that must be addressed before considering criteria, this effort must go forward with a sense of urgency.

Due to the size and diversity of the group and their opinions, an informal show of hands was requested to see where the majority stood on whether ABET should accredit information technology programs.

While a large majority of the attendees felt that ABET is the right organization and now is the time to move forward with information technology accreditation, there were some caveats. One concern expressed was that accreditation might set standards too soon, but others pointed out that ABET now uses outcomes based accreditation to great success; therefore, keeping programs current is an integral part of the accreditation process. Another concern was that, with forty participants, not all constituencies were represented at the colloquium. This is a realistic concern and must be addressed.

NEXT STEPS

ABET has taken steps to cast a wider net of participation by scheduling a panel as part of the 2003 ABET Annual Meeting, the theme of which is ABET 2020: Face the Future. This theme is an appropriate one, as decisions made now on many of the issues related to information technology will affect its constituencies far into the future, and rapidly changing technological advances and increasingly diverse job functions will require a structure for an equally rapid response to them.

A task group comprised of several colloquium participants and ABET staff is currently working to identify panelists and breakout session topics for the Thursday, October 30th session in Minneapolis, MN. Members include:

- Russ Shackelford, Stanford University, Chair, ACM Education Board
- Rebecca Miller, Ramtech
- Deborah Scherer, Stanford University, IEEE-CS Vice President for Educational Activities
- Barbara Price, Georgia Southern, Founding Director, School of Information Technology
- Doris Lidtke, ABET, Inc., Adjunct Accreditation Director, Computing
- Maryanne Weiss, ABET, Inc., Education and Information Services Director

Questions about this session or suggestions of other groups or individuals who should be invited to attend the meeting, which is open to all, are welcome and can be sent to Maryanne Weiss, ABET, Inc., Director of Education and Information Services, at mweiss@abet.org.

CONCLUSIONS IN BRIEF

The group concurred on several important conclusions: that the colloquium helped to further the national dialogue that must ensue to do this once and do it correctly; that their continued commitment and that of prospective participants is necessary to seek resolution to this complex problem; that more organizations/constituencies must be included in future meetings and workshops; and that ABET has a unique opportunity to assume leadership now and begin to more toward outcomes-based assessment to accredit undergraduate information technology programs.