Identifying and Evaluating Information Technology Bachelor's Degree Programs

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ABSTRACT
This paper describes the process for identifying and evaluating Information Technology (IT) bachelor's programs in the United States, in an effort to answer the question, how many IT bachelor's programs are there in the US? Due to widespread variation in the names of academic degree programs, one cannot simply count those named Information Technology. At SIGITE 2011, a framework was presented for identifying IT programs and for evaluating their compliance to an accepted standard. This framework, with slight modifications, has been applied throughout this research. We first compiled a list of prospective IT programs to research. Each university on the list was researched by looking at their university webpage in search of a list of computing majors listed at that university. If, at a glance, these program's required courses look similar to those required in an IT program, the program was evaluated and given a numerical score compliance factor, as compared to the standard, no matter the name of the major. This compliance factor is calculated using the assessment form that is included in this document. The results of this analysis are presented.

Categories and Subject Descriptors
K.2.3 [Information systems education]

General Terms
Computing Programs, Information Technology

Keywords
Information Technology; Model Curriculum

1. INTRODUCTION
What is an Information Technology program? How do we identify Information Technology programs amongst other computing programs? And, once an IT program is found, how well does it conform to an accepted standard?

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The Special Interest Group for Information Technology Education (SIGITE) of the Association for Computing Machinery (ACM) set out to answer these questions. SIGITE was interested in determining how many IT programs exist nationwide. As of this writing, there are 18 IT programs accredited by CAC of ABET in the USA.

The results of this research will enable further studies of IT programs in the US, including job placement, GPA, graduate studies, etc.

2. METHODS
2.1 Identification of Potential IT Programs
Because not all IT programs are named "Information Technology," a list of potential IT programs needed to be created. This list needed to include all potential IT programs, ideally. Each potential IT program needed to be compared to the IT Model Curriculum [1]. To create this list, each of the three researchers was given the task of searching for their own list of IT programs. These lists were to be obtained with the following criteria:

- The list should contain all of the 18 ABET-accredited IT programs.
- The list should have a large number of programs in common with the other researcher's lists.
- The list should be as comprehensive as possible without becoming too large.

Using the Internet, we then searched for sources for these lists. Once each researcher was confident that their list met the above criteria, a comparison was made between all of the lists. This comparison looked for overlap and inclusion of all the ABET-accredited IT programs. These individual lists were later combined. This combination process will be discussed later. The combined list will be referenced as the "master list" for convenience.

Perhaps the most helpful resource was the National Center for Education Statistics College Navigator. [3] The master list relied heavily on this source due to its comprehensive data and ease of use. This resource was able to query a National Education Statistics database to include the names of majors that could potentially be IT programs. After a combination of the three initial lists was made, we found that some of the ABET-

accredited IT programs were not included. This issue led to a need for broader search criteria in this resource to include these IT programs. In the end, the entire category of "Computer and Information Sciences and Support Services," was required to include all the ABET-accredited IT programs and other potential programs under the same definition (See Figure 1).

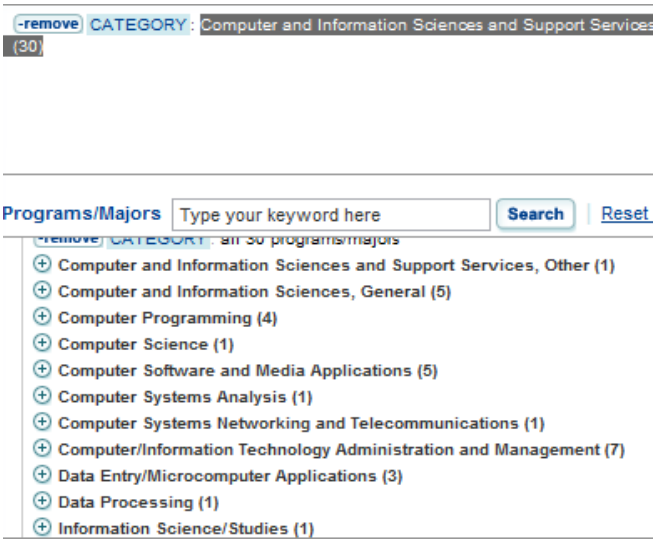

Figure 1 Screenshot of Majors included in the NCES filtered search

This was primarily because the University of Florida has an ABET-accredited IT program named "Computing and Information Sciences, Information Technology, BS." This meant that the University of Florida would only be included in the list if the entire category was included. Drexel also has its IT major in the "College of Information Sciences and Technology". Other ABET-accredited IT programs were named "Computer and Information Technology" (Purdue University at West Lafayette) and "Computing with concentration in Information Technology" (Indiana University-Purdue University Indianapolis).

Once a complete list from the National Center for Education Statistics College Navigator was obtained, the creation of the master list took place. Each researcher's list was combined with the College Navigator List. The three lists were of different size and came from different sources. Overlap was calculated by removing duplicates from the combined list in a Microsoft Excel spreadsheet. The compiled list of all three individual lists contained 909 academic institutions, with 291 duplicates between all three lists, and included all 18 ABET-accredited IT programs.

This extensive list compilation and combination process was taken to ensure that no potential IT program was excluded, that all ABET-accredited IT programs were included, and to ensure a comprehensive research project without evaluating all the >2000 institutions of higher education in the US.

2.1 Removing Evaluation Bias

Once this master list was compiled, there was a need to remove bias in evaluations of the identified programs. To do this, three ABET-accredited IT programs were chosen for all three researchers to evaluate independently within a week. Then, the three results were compared with all the researchers and each researcher had to explain why they scored each topic the way they did. If disagreements arose, further investigation into the course catalogue and class descriptions by all the researchers was taken until a unanimous score was reasoned. This process was overseen by the lead researcher, an IT professor and member of SIGITE. Any major topic that was not within 2 points of the other researchers was investigated further in the manner described. This process was repeated for a total of 7 ABET-accredited IT programs. The results were then compiled.

2.2 Identifying an IT Curriculum

Many of the programs on the master list would not be considered IT programs. To determine if each program was a potential IT program, each institution on the list went through a web research process, which entailed the following procedures:

1. Visiting the Official University Webpage.
2. Finding a list of all computing majors or a comprehensive list of majors for that university.
3. Determining if each computing major looks like IT:
    a) Must contain most of the 5 "pillars of IT" (See Figure 2).

Programs with questionable identities were consulted upon with other researchers and the lead researcher. Once a program was identified to be a potential IT program, an evaluation of the compliance factor took place.

2.3 Evaluating the programs

Programs were evaluated using the following procedures:

1) Visit the official webpage of the identified university.
2) If possible, obtain a current university course catalog.
3) If possible, obtain a required courses listing for the major to be evaluated.

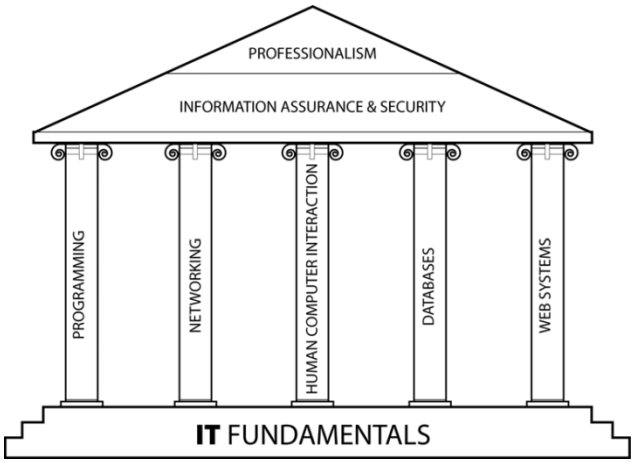

Figure 2 - Pillars of Information Technology [1]

4) Using both the course catalog and course listings/ descriptions, evaluate the compliance using the assessment framework. [2] This is described further below.

5) Compute IT Compliance Factor from the assessment framework.

These programs were evaluated using the 2008 SIGITE Model Curriculum [1] for four-year bachelors programs, and the assessment framework for identifying IT programs from proceedings of the 2011 SIGITE conference. [2] In summary, evaluation of a program's curriculum involved using a table and reference curriculum as a checklist. The evaluation process is described as follows from the assessment framework: "Measures are assessed using a simple point system. If a measure is met by the institution's curriculum, a point is awarded. If a measure is not met, no point is given. This simple scoring system will allow programs that exceed a stated threshold to be classified as fully conforming programs; it will also provide a simple indicator to the portion of IT 2008 compliant content for partially conforming programs. Each point corresponds to the IT Body of Knowledge summary found on page 27 of the 2008 Model Curriculum." [2] [6] An ideal form (Table 1) and a sample evaluation (Table 2) are given below.

The data from each of these forms were compiled and sorted. This research shows that all 909 institutions fall into the following categories in the spreadsheet:

- Identified as IT and evaluated (given a compliance factor score).
- Identified as not IT (no compliance factor score).
- Identified as IT initially but the evaluation was stopped before completion due to low compliance.

Table 1 – Assessment Summary (Performed against Website)

IT 2008 Body of Knowledge Core Topic Title	Module Type		Points Available
	Core	Elective	
IT Fundamentals	4		4
Human Computer Interaction	7		7
Information Assurance and Security	11		11
Information Management	6		6
Integrative Programming & Techniques	7		7
Mathematics and Statistics for IT	7		7
Foundations of Networking	6		6
Programming Fundamentals	5		5
Platform Technologies	6		6
System Administration and Maintenance	4		4
System Integration and Architecture	7		7
Social and Professional Issues	9		9
Web Systems and Technologies	6		6
TOTAL	85	0	85
Weighted Total (multiply TOTAL by 2)	1.000	0.000	1.00
Instructions for Weighted Total Calculation	*Divide total by 85 and enter above*	*Divide total by 170 and enter above*	
Core Coverage (Sum of weighted totals *2)	2.000		2.00
Capstone Experience (0.5 pts/semester)	1		1.00
Core content less than 50% of total content?	1		1.00
Final Compliance Factor (total of 3 values)	***4.000***		4.00

2.4 Reasons for Not Evaluating a Program

Most decisions made on evaluation were made in the identification process, including the decision to not evaluate at all, or to evaluate despite a seemingly low compliance. Some decisions to discontinue evaluation occurred mid-evaluation. The primary reasons for not evaluating a listed program are as follows:

- Program focus on algorithms, AI, or graphics (looked like Computer Science (CS))

Table 2 – BYU IT Program Evaluation

IT 2008 Body of Knowledge Core Topic Title	Module Type		Points Available
	Core	Elective	
IT Fundamentals	4		4
Human Computer Interaction	7		7
Information Assurance and Security	9		11
Information Management	6		6
Integrative Programming & Techniques	5		7
Mathematics and Statistics for IT	6		7
Foundations of Networking	6		6
Programming Fundamentals	4		5
Platform Technologies	2		6
System Administration and Maintenance	2		4
System Integration and Architecture	3		7
Social and Professional Issues	7		9
Web Systems and Technologies	6		6
TOTAL	67	0	85
Weighted Total (multiply TOTAL by 2)	0.788	0.000	1.00
Instructions for Weighted Total Calculation	*Divide total by 85 and enter above*	*Divide total by 170 and enter above*	
Core Coverage (Sum of weighted totals *2)	1.576		2.00
Capstone Experience (0.5 pts/semester)	1		1.00
Core content less than 50% of total content?(award 1 if yes, 0 if no)	1		1.00
Final Compliance Factor (total of 3 values)	***3.576***		4.00

- Program focus on management, accounting, or e-commerce (looked like Information Systems (ISYS))
- Website in Spanish, mostly the case for Puerto Rico.
- Website did not provide enough information (no course catalogue, list of majors, or course descriptions)

2.5 Modifications of the Evaluation Form

After the initial scoring of ABET-accredited IT programs, some modifications were needed on the assessment form. These included:

- Scoring of the capstone to be one point instead of two points. This was based simply on inclusion of a capstone course/program. The reason for this change was that the largest compliance factor was 4, and 2 was too large a weight. It also allows accommodating programs on a semester or quarter system.
- The Weighted Total to be out of 2 instead of 1. This change was to increase the weight of the other courses included in the evaluation.

3. CURRENT RESULTS

The compiled master list consisted of 909 institutions with computing programs. Of those, approximately 350 went through some of the identification process. Of those 350 programs, 220 were identified as being close enough to IT programs that they were assigned compliance factor scores according to curriculum fit. Some programs lacked sufficient information on the Web to permit an assessment. All 18 ABET accredited IT programs were evaluated and found to have high compliance factors.

Of the programs evaluated, there were a few trends:

- Human Computer Interaction (HCI) was often lacking in programs
- "Applied Computer Science" programs were most likely IT
- Some programs were called IT but did not include the IT pillars, and were actually ISYS, CS, etc.
- Some hybrid majors were included: "Information Systems Technology," "Computer Science Technology", "Computer and Information Science".
- Many technical institutions offered concentrations in specific IT pillars.
- As might be expected, few, if any, "CS" labeled programs were actually IT.

The end product of this research is the comprehensive, sorted list of all evaluated IT programs with their associated compliance factor. This includes the compliance factors of the universities in a summarized form. Table 3 gives an example of this.

Table 3: Universities and Their Associated Compliance Factors

University	Campus	Name of Major	Compliance Factor
Brigham Young University	Provo, UT	Information Technology	3.576
Southern Polytechnic State University	Marietta, GA	Information Technology	3.74
New Jersey Institute of Technology	Newark, NJ	Information Technology	3.859
…	…	…	…

Since the complete table of these findings is much too large to be included in this paper, it can be found at:

http://www.et.byu.edu/~luntb/SIGITE/index.html. This URL includes a table of all the 220 institutions included in the analysis, sorted both by institution name and by their respective compliance factor. It also includes the master list of the 909 institutions with which this research began.

Another very interesting part of our findings are in Table 4, which lists the different names the IT programs were known by, and the respective number of each. Gratifyingly, we see that the majority of these programs that we would consider to be IT programs are titled, Information Technology. But it is indeed interesting to see the range of other names used.

Table 4: Various Names of Evaluated IT Programs

Program Name	# of Occurrences
Information Technology	113
Computer Information Systems	19
IT concentration/emph. in Computer Science	9
Computer IT	6
Information Systems	6
Computer Information Science	4
Computer and IT	3
Computer and Information Science(s)	3
Applied Computer Science	2
Computer Security	2
Computing and IT	2
Information Sciences & Technologies	2
IT concentration in Computer Information Systems	2
IT Management	2
IT and Systems	2
IT Systems	2
Advancing Computer Science	1
Applied Computer Science & Information Systems	1
Applied Computing Systems & Technology	1
Applied IT	1
Computer Information Systems & Security	1
Computer Information Systems & Technology	1
Computer Science & Networking	1
Computer Systems	1
Computer Systems Management Applications	1
Computer Systems Science	1
Computer Technology Management	1
Information and Computer Technology	1
Information and Technology Management	1
Information Assurance & Security	1
Information Assurance/Network & IT Administration	1
Information Engineering Technology	1
Information Management & Technology	1
Information Science	1
Information Science, Systems & Technology	1
Information Security	1
Information Systems Management	1
Information Systems & Technology	1
Information Systems concentration in	1

Computer Science	
IT and Business	1
IT Applications	1
IT concentration in Business Administration	1
IT concentration in Professional Studies	1
IT emphasis in Computing Technology	1
IT Engineering	1
IT Leadership	1
IT option in Information Systems	1
IT and Informatics	1
IT and Management	1
IT and Security	1
IT and Web Science	1
IT-Systems & Security	1
IT track in Computer Science	1
Management Information Systems	1
Network and System Administration	1
Networking emphasis in Computer Science	1
Technology Information Systems	1

We also found that of these 220 programs that were evaluated, 210 (95.5%) of them were BS programs, 7 (3.2%) of them were BA programs, 2 (0.9%) of them were BAS (Bachelors of Applied Science) programs, and 1 (0.5%) was a BAT (Bachelors of Applied Technology) program.

This research has become increasingly more important as new programs and trends are being discovered. This research will be used to reach out to IT educators in the nation, establish a larger IT community, and further define and identify IT as an academic discipline.

4. ACKNOWLEDGMENTS

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5. REFERENCES

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