AN EMPIRICAL COMPARISON OF BACCALAUREATE PROGRAMS IN COMPUTING

Barry Lunt[1], Han Reichgelt[2], Tina Ashford[3], Andy Phelps[4], Erick Slazinski[5], Cheryl Willis[6]

Abstract *– When a new academic discipline emerges, it is often difficult to distinguish it from the disciplines closely related to it. Information Technology (IT) is just such an emerging discipline. This paper outlines the emergence of the Society for Information Technology Educatioin (SITE), a definition of IT curriculum, and positions IT relative to similar disciplines by empirically comparing it to programs such as Computer Science, Computer Engineering, Electrical Engineering, EET/ Telecommunications Engineering Technology, Information Science, and Management Information Systems, at a total of 12 institutions.*

Index Terms – academic disciplines, computing, curriculum, information technology,

INTRODUCTION

Recently, a number of Universities in the United States and elsewhere have started baccalaureate programs in Information Technology (IT). In addition to the universities with which the authors are affiliated, other institutions include Capella University, Illinois State University, Indiana University, Pennsylvania College of Technology, State University of New York at Morrisville, the University of Baltimore, and the University of South Alabama. Most of the institutions in question have added the baccalaureate degree in Information Technology to other computing-related baccalaureate degrees already in their portfolio, such as degrees in Computer and/or Electronic Engineering, Computer Science, Information Systems, Computer Information Systems, Management Information Systems, and so on.

While some (e.g., Denning, 2001) welcome this development, others are less accommodating and argue that there is nothing that would make a baccalaureate program in IT sufficiently distinct from a baccalaureate program in an existing computing discipline to warrant a separate degree program.

There are two popular methodologies that one can use to try to refute the proposition that there are no significant differences between a baccalaureate program in IT and other computing programs. The first one is to engage in a more philosophical debate about the nature of IT and to distinguish it theoretically from, say, Computer Science or Information Systems. While such debate is not without merit, the results are often inconclusive, and opinions that were closely held when entering such a debate are, in general, not likely to be modified.

In this paper, we therefore adopt a second methodology that one might use in support of a particular position, namely an empirical investigation. The aim of this paper is to provide an empirical comparison between the structure of IT programs and the structure of other computing programs in support of the position that IT programs have a character of their own and are distinct from other computing programs.

METHODOLOGY

The problem with any empirical comparison is of course the measure that one uses. In this particular instance, the question is specifically how to determine the structure of a degree program. Courses that were required in each of the degree programs were classified into one of 7 categories, namely

- Business related courses;
- Courses concentrating on interpersonal communication;
- Software related courses;
- Courses on networking, web-related technologies or databases;
- Electronics and signals;
- Hardware;
- Physics, mathematics or chemistry.

Absent from the above categories are general education courses that were
taken by all students at that particular institution because they are not unique to a given major, and therefore do not help define differences between majors.

The reason for classifying courses in this way was not arbitrary. In December of 2001, 15 representatives from schools currently offering baccalaureate programs in IT attended the first Conference on Information Technology

[1] Barry M. Lunt, Information Technology, 265 CTB, Brigham Young University, Provo, Utah, USA, luntb@byu.edu

[2] Han Reichgelt, Information Technology, PO Box 8150, Georgia Southern University, Statesboro, GA, USA, han@gasou.edu

[3] Tina Ashford, Information Technology, H113, Macon State College, Macon, GA, USA, TAshford@mail.maconstate.edu

[4] Andy Phelps, Information Technology, 102 Lomb Memorial Dr., Rochester Institute of Technology, Rochester, NY, USA, amp@it.rit.edu

[5] Erick Slazinski, Computer Technology, 1421 Knoy Hall, Purdue University, West Lafayette, IN, USA, edslazinski@tech.purdue.edu

[6] Cheryl Willis, Industrial Technology, 334 T2, University of Houston, Houston, TX, USA, clwillis@uh.edu

Curricula (CITC I) in Aspen Grove, Utah, to discuss a number of IT related issues. One of the topics for discussion was IT curricula and delegates at the conference engaged in an exercise to capture their views on what a core IT curriculum should contain. Each delegate was asked to write down ach topics that they felt were important in an IT curriculum on a separate piece of paper. Some 700 pieces of paper were collected, with some obviously mentioning the same topic.

The topics thus collected were then classified into a number of categories, and their frequencies noted. 28 categories emerged from this exercise, of which the most frequent were

- Networking;
- Interpersonal communication;
- Software;
- Web systems design;
- Databases;
- Business related issues (e.g., project management, e-business, organizational structure);
- Digital communications;
- Data security/privacy;
- Mathematics;
- Systems design;
- Hardware.

Further details can be found in Lunt et al (2002).

The first author used these topics as a starting point in a pilot study to analyze the various computing and related degrees offered at Brigham Young University (BYU), Utah. In addition to Information Technology, BYU-Utah offers baccalaureate degrees in Computer Engineering, Computer Science, Electrical Engineering, and Management Information Systems. It was on the basis of this pilot study that he combined several of the categories to arrive at the seven categories mentioned earlier, and used throughout this study.

The numbers used in the study represent unit courses, the equivalent of 3 semester credit hours. This was done to simplify understanding of the comparison. If a course was listed as 2 semester credit hours, it counted as .667 classes.

One further issue that needed to be resolved was the fact that many programs allow students options and the question was how to rate these options. The methodology that we used was simply to score each course by a ratio. Thus, if the student was required to choose 2 out of 5 courses, then each course was given a rating of .4 (2/5).

In addition to his or her own institution, each author also analyzed the programs offered at one other institution. The only requirement was that the institution in question should offer a baccalaureate program in IT. This led to programs at the following institutions being analyzed:

- Brigham Young University, Provo (BYU);
- Capella University (Capella);
- George Mason University (GMU);
- Georgia Southern University (GSU);
- Macon State College (MSC);
- Pennsylvania College of Technology (PCT);
- Purdue University (Purdue);
- Rochester Institute of Technology (RIT);
- University of Baltimore (U of B);
- University of Houston (U of H);
- University of South Alabama (U of SA).

RESULTS

The summary table of the results of this study are given in Table 1 below. The study covered seven main academic disciplines, shown in alphabetical order in Table 1. In some cases, the names of these disciplines were a combination of similar programs, as in the cases of Computer Eng/Eng Tech (a combination of programs in Computer Engineering and Computer Engineering Technology), EET/Telecomm ET (a combination of programs in Electronics Engineering Technology and Telecommunications Engineering Technology), and Mgmt Information Systems (a combination of programs in Information Systems and Management Information Systems). This was done only after it was evident from the data gathered that these programs were similar enough to be counted together; it is not suggested by this study that these programs are identical.

One of the first things a person will notice when looking at Part 2 of Table 1 is the large number of programs found under the discipline of Information Technology. This is due to two factors: 1) every institution included in this study had to have a program in IT, or it would not have been included; and 2) some of the institutions included have multiple specializations within their program of IT, and they were different enough that they were included separately. This gave a total of 22 IT programs in the study. This was followed by 8 programs in Computer Science, 8 in Management Information Systems, 5 in Computer Eng/Eng Tech, 2 in Electrical Engineering, 2 in EET/Telecomm ET, and one in Information Science.

The number of courses required for the programs included in this study ranged from a high of 35 (Information Technology at Capella) to a low of 15 (Computer Engineering at GMU), with the average being just under 26 courses. The seven program areas had averages ranging from a high of 29.8 courses for EET/Telecomm ET to a low of 23.25 for Computer Science.

COMPARISON

It can be seen from the data in Table 1 that there is a great degree of variation in programs between institutions, even in programs as well-established as Computer Science. However, when one looks at the trends of the averages, the respective disciplines become very distinct. This is perhaps best shown in Figure 1, which is a graph of the percentage of classes required in each sub-area. For example, Figure 1 readily shows where the emphasis lies for

programs in MIS: about 58% of all their required classes are in Business, with the other 42% being made up of Networking, Web & Databases (18%), Software (11%), Interpersonal Communications (6%), and Physics, Math & Chemistry (6%). There is essentially no required coursework in Hardware or Electronics & Signals.

This can be contrasted with programs in Computer Science, where the main components are Software (39%), Physics, Math & Chemistry (30%), Networking, Web & Databases (10%), Hardware

(8%), Interpersonal Communications (4%) and a bit of Business (3%). This comparative view of the courses required in each topic area for each of the programs is best seen in Figures 2-7, one for each of the respective academic programs.

A comparison between the topics areas required for each program is the focus of this paper. Figures 2-8 show the relative ranks between the topic areas for each of the programs included in this study.

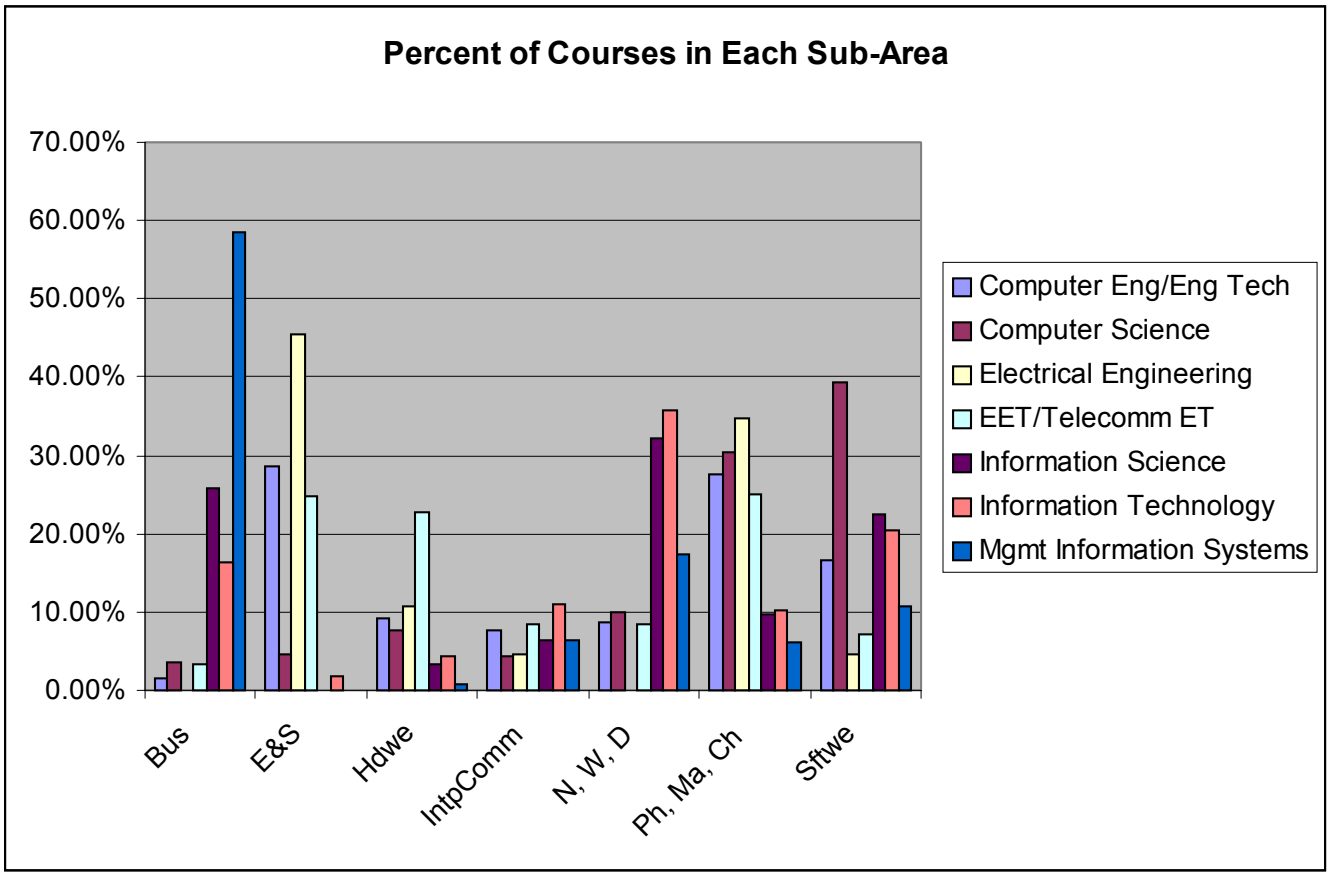


FIGURE 1

NUMBER OF COURSES REQUIRED BY EACH PROGRAM IN EACH SUB-AREA

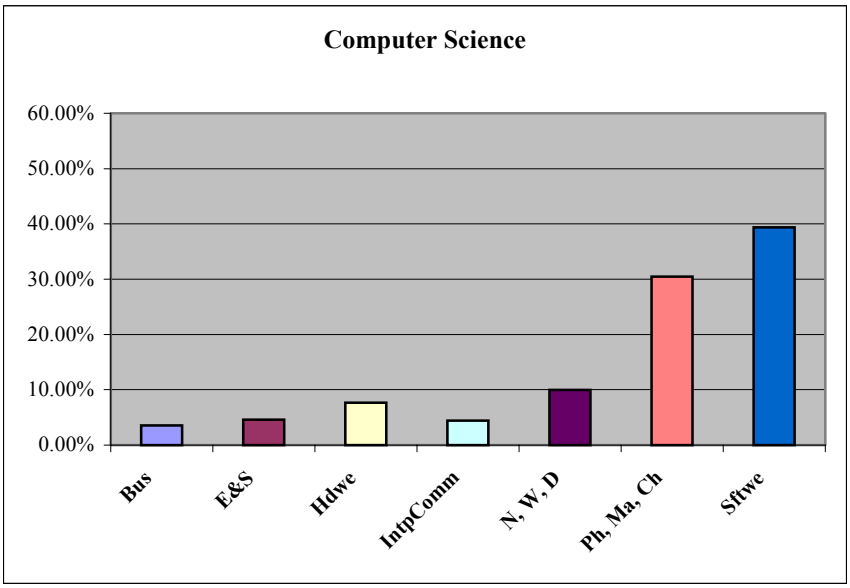
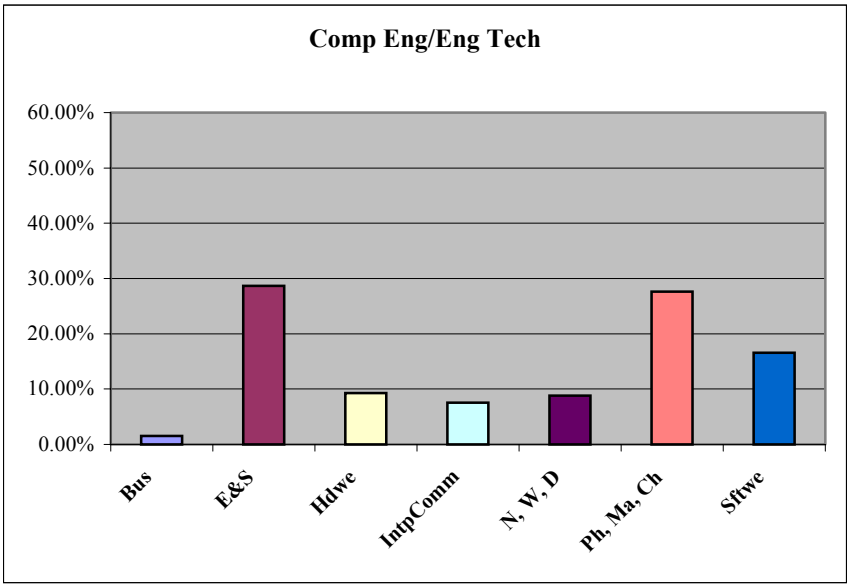


Figure 3
TOPIC AREAS BY RANK FOR PROGRAMS IN COMPUTER SCIENCE.



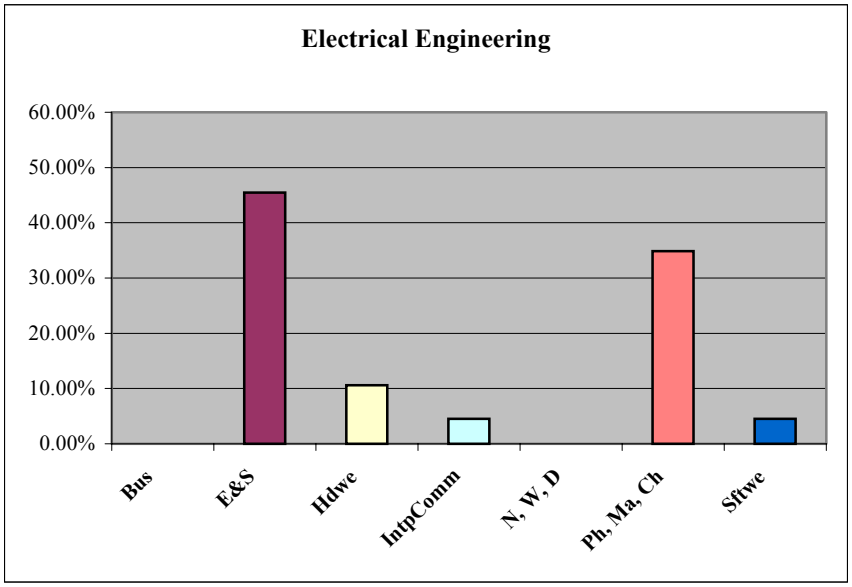


Figure 4
TOPIC AREAS BY RANK FOR PROGRAMS IN ELECTRICAL ENGINEERING.

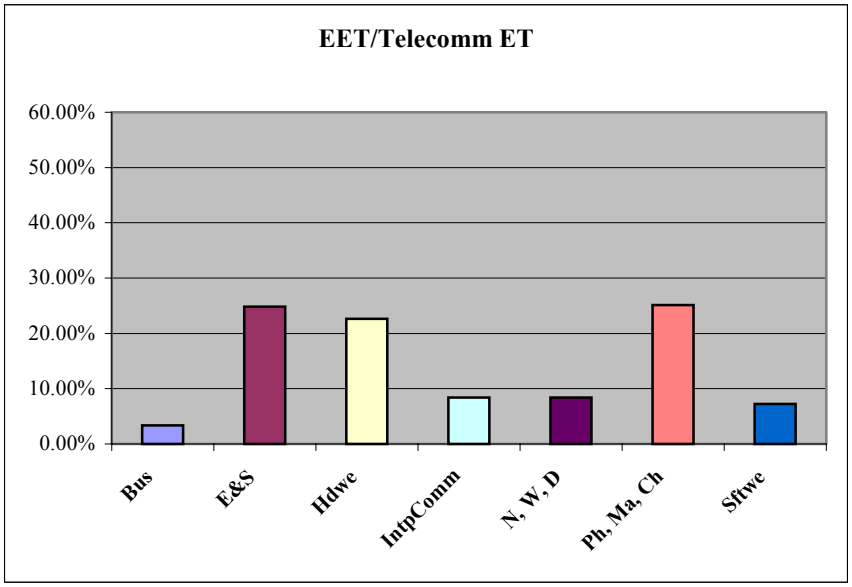


Figure 5
TOPIC AREAS BY RANK FOR PROGRAMS IN ELECTRONICS ENGINEERING TECHNOLOGY AND TELECOMMUNICATIONS ENG. TECH

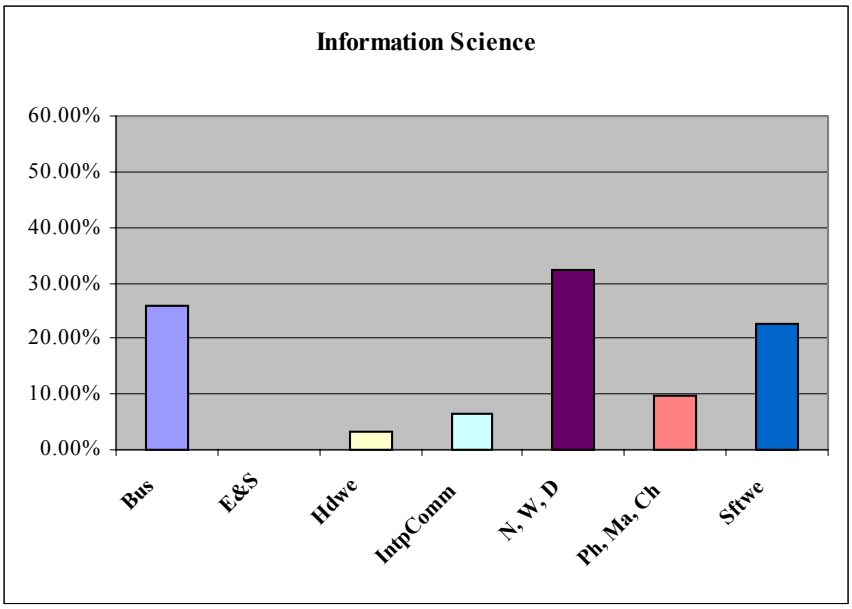


Figure 6
TOPIC AREAS BY RANK FOR PROGRAMS IN INFORMATION SYSTEMS

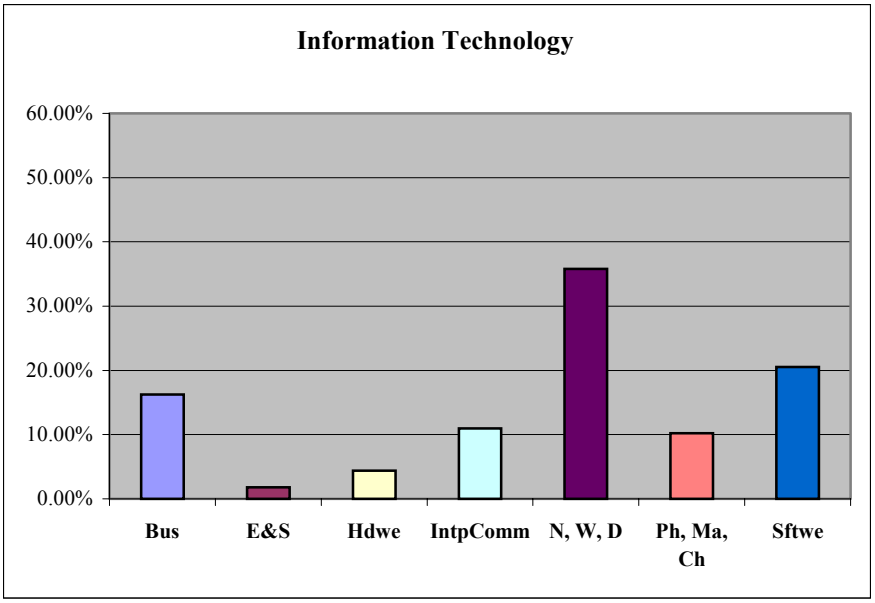


Figure 7
TOPIC AREAS BY RANK FOR PROGRAMS IN INFORMATION TECHNOLOGY.

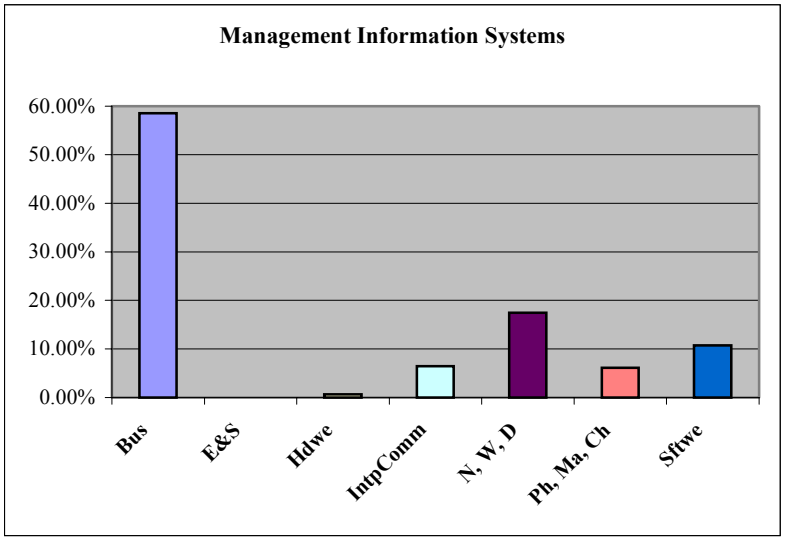


Figure 8
TOPIC AREAS BY RANK FOR PROGRAMS IN MANAGEMENT INFORMATION SYSTEMS.

It is typical for any program to have two or three strength areas, followed by appropriate support topic areas. It is evident from Figures 6 and 7 that the strength areas for programs in Information Systems and Information Technology are 1) Networking, Web & Databases; 2) Software; and 3) Business, with only a slight difference in the #2 and #3 areas. The strength areas for programs in Computer Engineering or Computer Engineering Technology are 1) Electronics & Signals and 2) Physics, Math & Chemistry, which shows their strong emphasis on electronics and basic engineering principles. A similar emphasis is seen in programs in Electrical Engineering, where the strength areas are the same, but make up a much greater part of the curriculum. Similarly, the strength areas in programs in Electronics Engineering Technology or Telecommunications Engineering Technology are 1) Physics, Math & Chemistry; 2) Electronics & Signals; and 3) Hardware, making up a combined 72% of the curriculum.

As one would expect, the strength areas of programs in Computer Science are 1) Software and 2) Physics, Math & Chemistry, with an emphasis on the Math. And also, as implied by the name, the focus of programs in Management Information Systems is Business, making up over 50% of the curriculum,

with a secondary emphasis in Networking, Web & Databases making up about 18% of the curriculum.

CONCLUSION

It is the hope of the authors of this study that the preceding information, especially the tables and graphs, will be helpful in two main endeavors: clarifying the differences and unique characteristics of existing programs in Information Technology, and assisting in academic advisement in the field of computing. When any new program emerges from closely related programs, it is often difficult for those in the closely related programs to clearly distinguish the differences between these programs, and to understand the unique focus of the new program. This paper has presented information which should significantly promulgate a better understanding.

Many are the students who are interested in the broad area of computers, but a large number of these students are quite unaware of the different programs that deal with computing and their respective emphases. This paper should be very helpful in clarifying this situation as well. For example, a student interested primarily in the Networking, Web and Databases part of computing would be well advised to go into either Information Systems or Information Technology. Those interested primarily in the software should go into Computer Science, while those whose interests lie most strongly in computer hardware should be advised into programs in Computer Engineering, Computer Engineering Technology, Electronics Engineering Technology, or Telecommunications Engineering Technology. Students who love the business applications of computers should be advised into Management Information Systems.

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