

Towards a better understanding of the IT program at CCIS/KSU

Hend Al-Khalifa, PhD Nadia Al-Ghreimil, PhD Maha Al-Yahya, PhD

*Information Technology Department
College of Computer and Information Sciences
King Saud University*

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Abstract

Four years ago the College of Computer and Information Sciences at King Saud University started the development of a new Bachelor of Science degree majoring in Information Technology for female students. As the program is now in its second year of application, this paper presents the current program implementation, a comparison of its curriculum against national and international programs and the compliance of our current program with international standards.

Introduction

In the last ten years or so, there has been significant focus on Information Technology (IT) as a new academic discipline. The rapid developments in the market place and the evolving demand from the industry have both shaped the face of the IT discipline. This discipline has evolved in the 1990's by a small number of universities that developed alternative computing curricula from those recommended by the traditional computer science curriculum of the ACM. These alternative curricula had an emphasis on the use of the technologies that underlie the World Wide Web: networks, databases, web site development, and human computer interactions (Sobiesk et al., 2006). Among the earliest IT curricula were those offered by Rochester Institute of Technology, Brigham Young University and Georgia Southern University (Sobiesk et al., 2006).

IT as defined by Spooner (Spooner, 2000) is a term that denotes the use and applications of computers and communications in industry, business, government and entertainment. This definition implies that IT has an interdisciplinary nature and it cannot stand by its own without the support of many other adjacent disciplines that benefit from and use IT.

Unlike any other degree in computing (i.e., Computer Science, Software Engineering and Information Systems), IT programs usually consists of three components (Spooner, 2002): 1) a set of distributed requirements in mathematics, science, humanities and social sciences, 2) core courses in IT Major, and 3) a specific discipline in IT. Thus, there are many specific disciplines for current IT programs world-wide, which include: web technologies, networking (Stockman et al., 2004), database and software development (Said et al., 2004).

In this paper we begin by stating our research questions that initiated the paper idea along with the significance of the study. In section 3, we present the IT program at

KSU and give an in depth description of its current curriculum. In section 4, the methodology used to compare our program against national and international programs is provided. Section 5 and 6, cover the results and the discussion of the comparison. Finally, section 7 concludes the paper by giving some recommendations.

Research Question and Significance of Study

After two semesters of applying the new IT program, we thought of revising the curriculum based on the new changes in this rapidly growing discipline. Therefore, this research paper will highlight the role of universities programs in achieving information economic progress, and benefit from its positive effects on the community's renaissance. Besides, this paper will identify challenges, difficulties, and problems that increase the widening of the information technology gap between our IT program and other similar programs world-wide.

Thus, this paper tries to answer the following research questions:

1. Whether there are similarities between IT programs offered by different institutions (nationally and internationally) and our program? And,
2. How well does the IT program adhere to international curriculum recommendations?

To answer these two questions, we first need to give a brief description of the current IT program at KSU followed by a detailed description of the curricula. Then we compare our curricula to other national and international programs based on a pre-defined methodology.

IT Program at KSU

It has only been one year since the new program for the Bachelor of Science degree in Information Technology has been implemented at the Information Technology (IT) Department of the College of Computer and Information Sciences (CCIS) at King Saud University (KSU) in the 2006/2007 academic year. The IT program came to replace the "Computer Applications" program that had been attracting students since 1987 when the department officially opened. At that time it was the only college department for females in such a discipline in the Kingdom of Saudi Arabia and thereby it was the first.

The department was initially named "Computer Applications Department". The name remained until 2005 (1426H) when it was changed to "Information Technology". Now the IT department is one of five departments at CCIS. The other four departments are: computer science, computer engineering, information systems, and recently software engineering. The IT department is only for female students, while the other four departments are only for male students (with regard to undergraduate study). Although

the IT department only offers a bachelors degree, there is still the possibility for graduate education by enrolling in the computer science or information systems masters program offered by the college or by studying abroad.

Currently, there are more than 1200 students enrolled in the IT department; that is 30 times as many as it started 20 years ago. This enrollment makes up about 50% of total undergraduate enrollment at the college. Unfortunately the number of faculty members in the IT department has just barely quadrupled since then, from 3 to 11. Therefore, the department depends very much on its lecturers (instructors holding Masters Degrees) who account to about 15.

The information technology program of study is designed to provide the nation with graduates who can efficiently and professionally participate in the IT market, whether for the government or the private sector. Graduates are expected to be able to apply their knowledge to the process of design and implementation of software systems as well as to apply information technology in various application areas. The program also establishes a solid base for future teachers of IT. To achieve that the program provides a broad education in the technology of computing by offering over 20 courses that span the full range of topics in modern information technology including two special topics courses that allow easy incorporation of new topics into the program. And it offers an educational path to qualify instructors for teaching. The total number of credit hours required for the Bachelor of Science degree in IT is 136.

Curriculum Details

The Information Technology program of study is a 4-year program with 136 required credit hours. There are no electives in the program which is due to current University regulations. We need to point out that the Computer Applications program was a 5-year program with the same number of required credit hours (136). Furthermore, the percentage of specialized IT courses has increased. Refer to Table 1 for the complete program of study for the IT major.

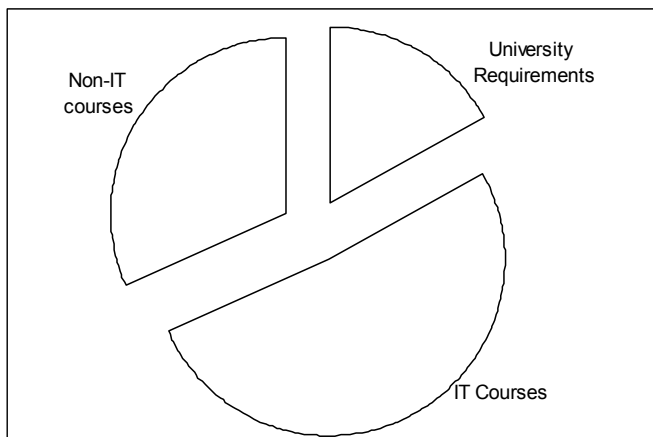
The courses are distributed as follows (see Figure 1):

- University requirements religion and language (Arabic and English): 23 hours = 16.9%
- Non-IT courses: 43 hours = 31.6%
- IT courses including the final 1 year long project: 70 hours = 51.5%

Table 1.
IT Program at
CCIS/KSU

Symbol & Number	LEVEL 1 Course Name	CR	Symbol & Number	LEVEL 2 Course Name	CR
CAP 107	Introduction to Computers	3	CSC 113	Computer Programming 2	4
CSC 112	Computer Programming 1	3	ENGL 104	Language for Computer Science 2	3
ENGL 102	Language for Computer Science1	6	MATH 102	Introduction to Integration	3
IC 101	Introduction to Islamic Culture	2	PHYS 104	General Physics 2	4
MATH 102	Introduction to Differentiation	3	ARAB 101	Language Skills	2
		17	IC 102	Islam and the Construction of Society	2
					18
Symbol and Number	LEVEL 3 Course Name	CR	Symbol and Number	LEVEL 4 Course Name	CR
CAP 211	Visual Programming	3	CAP 223	Computer Architecture	3
ENGL 110	Report Writing for Computer Science	2	STAT 324	Probability and Statistics	3
CSC 212	Data Structures	3	CAP 240	Networks and Internet Technologies	3
MATH 151	Discrete Math	3	CAP 252	System Analysis and Design	3
CAP 221	Computer Organization and Assembly Language	3	CAP 261	Fundamentals of Database Systems	3
CAP 250	Introduction to Information Systems	3	IC 103	The Islamic Economic System	2
		17			17
Symbol and Number	LEVEL 5 Course Name	CR	Symbol and Number	LEVEL 6 Course Name	CR
CAP 311	Web Engineering and Applications	3	CAP 312	Software Engineering	3
CAP 322	PC Environment and Peripherals	3	CAP 333	Network Management Systems	3
CAP 332	Operating Systems	3	IC 104	Fundamentals of Islamic Politics	2
MATH 244	Linear Algebra	3	CAP 364	Database Management Systems	4
ARAB 103	Expository Writing	2	STAT 111	Elements of Distribution Theory	3
ACCT 101	Principles of Accounting 1	3	ACCT 231	Cost Accounting 1	3
		17			18
Symbol and Number	LEVEL 7 Course Name	CR	Symbol and Number	LEVEL 8 Course Name	CR
CAP 430	Information Security	3	CHS 305	Management of Health Information	3
CAP 490	Selected Topics in IT 1	3	CAP 472	E-Business Systems	3
ART 412	Computer Graphics	2	CAP 492	Selected Topics in IT 2	3
BA 101	Principles of Management	3	BA 241	Marketing Management	3
OPS 241	Simulation Systems	3	CAP 497	Project 2	4
CAP 496	Project 1	2			
		16			16

Figure 1.
Course
Distribution



Methodology

To compare our curricula to other national and international programs we need to build our comparison on some systematic scientific approach, i.e. quantities measures. Consequently, we have adopted (Reichgelt et al., 2004) methodology in comparing different IT programs in US universities. In their procedure they classified the courses that make up the IT program into one of seven categories, which are:

- Business related courses (B)
- Courses concentrating on interpersonal communication (IC)
- Software related courses (SW)
- Courses on networking, web-related technologies or databases (NWD)
- Electronics and signals (ES)
- Hardware (HW)
- Mathematics and science (MS)

Their classification was not formed arbitrary. In fact, it was based on the input of 40 representatives from 15 schools offering IT programs in the US, further details about the formation of the categorization can be found in (Lunt et al., 2002).

We have also added an eighth category that covers language, religion, humanities, and social studies; we named it General Topics (GT).

In Reichgelt's et al. methodology, the equivalent of three-semester credit hours was used as the base unit.

(Semester hours are widely used in the United States, and increasingly elsewhere, as a measure of course load. 1 semester hour is equivalent to 1 lecture hour per week over a 15 week period, or 3 supervised lab hours per week over a 15 week period.) Thus, if a course was listed as 2 semester credit hours, it was given a number of .667. (Reichgelt et al., 2004).

Their heuristic was sound, which encouraged us to follow it as is.

National and Middle Eastern Programs

We first looked at two national IT programs offered by universities in Saudi Arabia. Next we searched for bachelor programs in IT offered by other universities in the Middle East. We found Mani and Lunt's paper very useful in locating some bachelor IT programs offered in the Gulf Cooperation Council (GCC) region (Mani, 2006) and found Wikipedia listing for Arab universities (Wikipedia 2007a) very helpful to spot other programs in the Middle East.

Some Palestinian and Egyptian universities offered dedicated programs for Information Technology. However, most Jordanian universities which have an IT college offer

bachelor degrees in Computer Science and Information System rather than in Information Technology in contrary to what the name of their college implies.

Below follows the list of Programs included in our study.

From Saudi Arabia:

- The bachelor degree in IT offered by the Faculty of Computing and Information Technology (CIT) at King Abdulaziz University in Jeddah with 128 credit hours (CIT, 2007).
- The bachelor degree in IT offered by the Arab Open University with 130 credit hours (AOU, 2007).

From GCC countries:

- The IT Department at Ahlia University in Bahrain requires 132 credit hours (Ahlia University, 2007)
- The Bachelor of Science program in Information Technology offered by the IT Department at Zayed University in UAE requires 123 credit hours (Zayed, 2007). Three concentrations are available: Web Technologies, Network Technologies and Information Security.
- The Bachelor of Science program offered by the College of Information Technology of the United Arab Emirates University in Dubai, UAE (IT, 2007). The college offers five tracks in IT: Intelligent Systems, Software Development, Networking, Information Security and Electronic Commerce (CIT, 2007). It requires 124 credit hours.

From other Middle Eastern countries:

- The Bachelor of Science program in Information Technology offered by the Arab American University in Jenin (Jenin, 2007)
- The program offered by the Faculty of Computers and Information of the Cairo University in Cairo, Egypt (Cairo University, 2007).
- The program offered by the Faculty of Computers and Informatics of the Zagazig University in Egypt (Zagazig University, 2007).

International Programs

To make our study comprehensive, universities from the Unites States of America, the United Kingdom, and Australia were chosen for analysis and comparison with our IT program. The only requirement for the inclusion of the university is that it offered a program in IT. The programs used in this analysis include the following:

From USA:

- Purdue University which offers a BSc in Information technology with a Net major with 124 credit hours. In addition it offers BSc degree I IT with a major in Information Systems and Technology with a total of 122 credit hours (Purdue, 2007).
- The University Of Cincinnati has a BSc in IT with a total of 184 credit hours (UC, 2007).
- The Brigham Young University has a BSc in IT with 120 credit hours (BYU,2007)
- Bryant University offers a BSc in IT with 123 credit hours (Bryant, 2007)
- Capella University – a distance learning program – has a BSc in Project Management (Information Technology) with a total of 120 credit hours (Capella, 2007).

From Australia:

- Griffith University (Bachelor of Information Technology) 240 credit points (Griffith, 2007)
- University of Sydney (Bachelor of Information Technology) 320 credit points (USYD1, 2007)

And finally, from the UK the University of Reading which offers a BSc in Information Technology with a total of 380 credit points (Reading, 2007) was considered in our study.

Results

In the following three sections we report back on our evaluation of the different national and international IT programs. Table 2 shows the breakdown of our IT program into different topic areas based on Reichgelt's et al. classification (see Methodology section above).

Table 2.
Breakdown of
KSU IT
program by
topic area

	IT courses (without project)					Non IT		Univ. Req	Total
	IC	SW	NWD	HW	ES	MS	B	GT	
IT Department-KSU - Saudi Arabia	0	10	7.3	4	0	8.3	6	7.67	43.27

National and Middle Eastern programs

Table 3 reports our findings for selected IT programs in Saudi Arabia and some Middle Eastern universities.

Table 3.
Breakdown of
National and
Middle
Eastern IT
programs by
topic area

	IC	SW	NWD	HW	ES	MS	B	GT	Total
CIT- Jeddah - Saudi Arabia	0	7	5	2	0	3	4	5	26
AOU- Saudi Arabia	1	17	11.66	0	0	2.67	0	4	36.33
BSIT- Ahlia University - Bahrain	0	12.7	6	1	0	5.34	2	8	35.04
CIT- Web Technologies - Zayed University - UAE	6.3	11	5	0	0	2	4	9.66	37.96
CIT- Network Technologies - Zayed University - UAE	5.3	9	7	0	0	2	4	10.66	37.96
CIT- Information Security- Zayed University - UAE	4.3	10	7	0	0	2	4	10.33	37.63
CIT- Software Development -UAE	7.99	11	4	1	0	6	3	2	34.99
CIT- Networking -UAE	7.99	4	11	1	0	6	3	2	34.99
CIT- Information Security - UAE	6.99	4	11	1	0	6	4	2	34.99
CIT- Electronic Commerce- UAE	6.99	5	7	1	0	6	5.96	2	33.95
IT - Arab American University – Palestine	3	8	4	4	0	7	1	5	32
IT- Faculty of Computers and Information -Cairo University –Egypt	3	13	14	6	4	8	0	2	50
IT- Zagazig University - Egypt	2.68	18	8	3.3	3	5.9	1.67	0.67	43.22

International programs

Although the crediting systems in national and Middle Eastern universities selected for the study used the US *credit-hour* (CH) system, this was not the case for some international universities. For example, in the UK the *Credit Accumulation Transfer* (CAT) system is used, which is referred to as the *credit point* system (NICATS 2007), (NICATS 2001). The same system is also used by some Australian universities.

The US credit system uses the notion of a *credit-hour* (CH) as its unit of credit. A three-credit course indicates the number of hours required in formal class and laboratory meetings per week and the number of credits received per term (Wikipedia, 2007). For example a 3 credit hour module would require three hours in the classroom.

The UK credit system is based on *Notional Learning Time* (RHUL 2007) (NICATS 2001) which is defined as the number of hours that it is expected a learner at a particular level will spend, on average, to achieve the specified learning outcomes at that level. The most widely used *credit point : notional learning time* ratio used is 1:10. So a typical module of 10 credit points requires approximately 100 hours of study (NICATS 2001).

From the previous discussion it is apparent that the credit hour system only counts the actual contact time and does not consider the student self study or the total time involved in learning. So, to make our comparison of programs with different crediting systems realistic we need a conversion formula, and because our IT program is specified using the US CH crediting system we opted to convert UK and Australian systems to the CH system.

Assuming for every credit hour (1 hour contact time) there is 3.5 hours self study, therefore a 3 credit hour module yields a notional learning time of approximately 10 hours per week. This assumption would enable us to convert credit points to credit hours based on the following formula: $10CP=3CH$.

We used this conversion formula in our analysis to convert UK and Australian programs to the US credit hour system in order to unify the comparison. However, for the University of Sydney, a different credit point value is computed, the university's Academic Board guidelines suggest that one credit point equates to approximately 1.5 to 2 hours of student effort per week. And therefore a 6 credit point module would be equivalent to approximately 10 hours per week and therefore the formula we used here is $6CP=3CH$ (USYD2, 2007).

Another issue which arose from this study was that some universities used the notion of quarter credits instead of semester credits, as in the case with Capella University. The quarter credit units were converted to the equivalent semester units using the following conversion formula (YA 2007): Semester credit = Quarter credit * 2/3.

Table 4 reports our findings for selected IT programs in International universities (US, UK and Australia).

Table 4.
Breakdown of
other
International
IT programs
by topic area

	IC	SW	NWD	HW	ES	MS	B	GT	Total
Purdue University (Net option)	6.3	5	7	0	2	6.3	3	5	34.6
Purdue University (IS and Technology option)	7.3	11	5	0	0	3	9	4	39.3
University Of Cincinnati	4.2	11.7	5.5	0.67	0	7.1	3.6	5.3	38.2
Brigham Young University	2	3	4	3.1	3.9	5	1	9.2	31.2
Bryant University (BSc in Information Technology)	5.3	6.3	1	2	0	8.3	7	5	34.9
Capella University (project management IT specialisation)	0.6	4.5	10.6	0	0	1.3	7.58	2.6	27.18
Griffith University (Bachelor of Information Technology)	1.4	10.6	4.9	0.6	0	2	2.4	3	24.9
University of Sydney (Bachelor of Information Technology)	1	18.4	2.6	2	1	3	1	4	33
University of Reading (BSc in Information Technology)	0	14	4.3	2	0	0	9.1	2	31.4

Comparing IT Program against ACM Recommendations

The Association for Computing Machinery (ACM) has long been known for producing model computing curricula for four major fields: computer engineering, computer science, software engineering, and information systems. In 2003, the Society for Information Technology Education (SITE) became an ACM Special Interest Group called SIGITE: Special Interest Group for Information Technology Education. In 2005, information technology was included as a fifth field in ACM's computing curricula and SIGITE produced the IT2005 curriculum volume (ACM, 2005).

This document lists the Information Technology Body of Knowledge which is divided into 12 Knowledge Areas (KA) which are further divided into Units. It also gives the number of hours that should be spent on each Unit. In total the Body of Knowledge covers 281 hours which are considered the core of any IT baccalaureate program; making up about 16% of a regular 4-year program with approximately 1800 hours. The document also lists the topics, core learning outcomes, and elective learning outcomes of listed Units in the different Knowledge Areas.

In an attempt to measure our IT Program's compliance with the Information Technology Body of Knowledge all instructors in the department were asked to indicate which topics and which core and elective outcomes they cover in the different courses they teach. From the information gathered it became obvious that some areas were better covered than others:

- Well covered KAs, i.e. those with more than 70% of the core hours covered, are: Information Management, Networking, Programming Fundamentals, and System Administration and Maintenance, Web Systems and Technologies.
- Moderately covered KAs, i.e. those with 40%-70% of the core hours covered, are: IT fundamentals, Information Assurance and Security, Platform Technologies, System Integration and Architecture,
- Poorly covered KAs, i.e. those with less than 40% of the core hours covered, are: Human-Computer Interaction, Integrative Programming Technologies, Social and Professional Issues.

Unfortunately, it also became apparent that some Units were not covered specifically in any course (see Table 5). This may be attributed to the fact that our program was developed before the publication of ACM recommendation for IT programs.

Table 5.
Uncovered
Units

HCI1. Human factors HCI2. Aspects of Application Domains HCI3. Human-Centered Evaluation HCI5. Accessibility HCI6. Emerging Technologies IAS1. Fundamental Aspects IAS3. Operational Issues IAS6. Security Domains IAS7. Forensics IAS8. Information States IPT1. Intersystem Communications IPT5. Software Security Practices IPT6. Miscellaneous Issues NET5. Application Areas	PT3. Computing Infrastructures PT4. Enterprise Deployment Software (min. 0 hours) SA4. Administrative Domains SIA6. Organizational Context SIA7. Architecture SP3. Social Context of Computing SP5. Intellectual Properties SP6. Legal Issues in Computing SP7. Organizational Context SP8. Professional and Ethical Issues & Responsibilities SP9. Privacy and Civil Liberties WS3. Digital Media WS5. Vulnerabilities (min. 0 hours)
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Discussion

In this paper we intended to answer two major questions, namely: 1) Whether there are similarities between IT programs offered by different institutions (nationally and internationally) and our program, and 2) how well our IT program adheres to international curriculum recommendations i.e., ACM IT curricula. Therefore, we discuss the foremost research question first.

Figure 2.
IT in Saudi

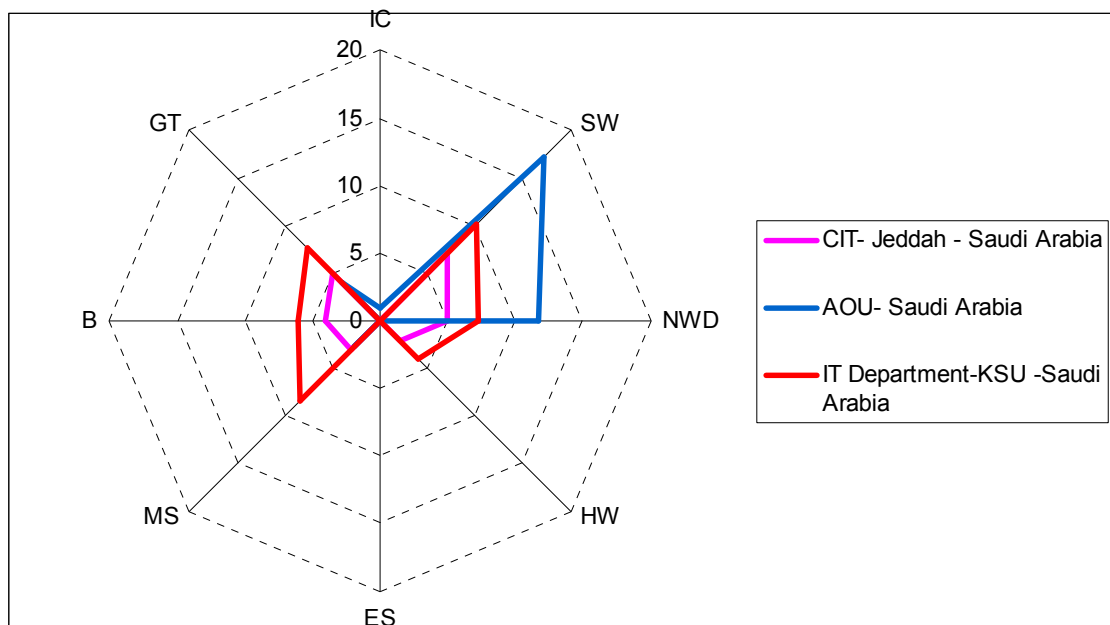


Figure 2, Figure 3, Figure 4 and Figure 5 show our IT program alongside the different national, GCC and Middle East universities programs plotted as radar charts. The chart

shows that most IT programs are oriented toward SW and NWD related subjects, however, our IT program (marked in red) seems slightly directed towards SW. Interestingly, most programs that have a concentration in a specific track in IT (e.g. DB, NW, Web, etc), have a spark in that track, however, our program does not have such a feature, because tracks have not been implemented yet (future plans include tracks in business applications, health applications and education (Al-Ghreimil 2007, personal communication, 6th Dec).

Figure 3.
IT in GCC (1)

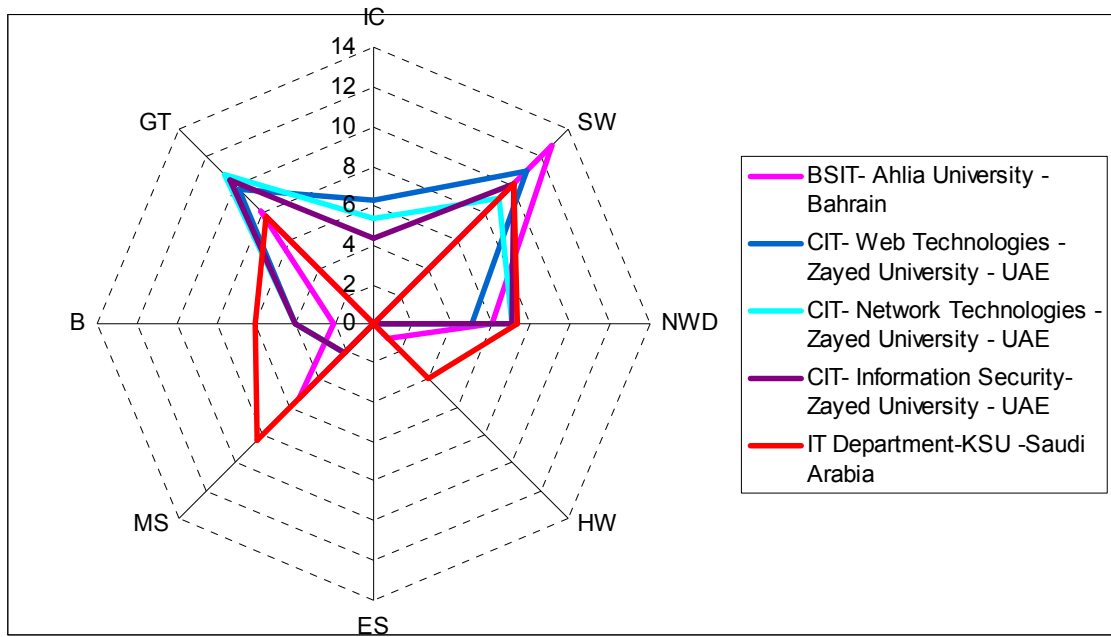


Figure 4.
IT in GCC (2)

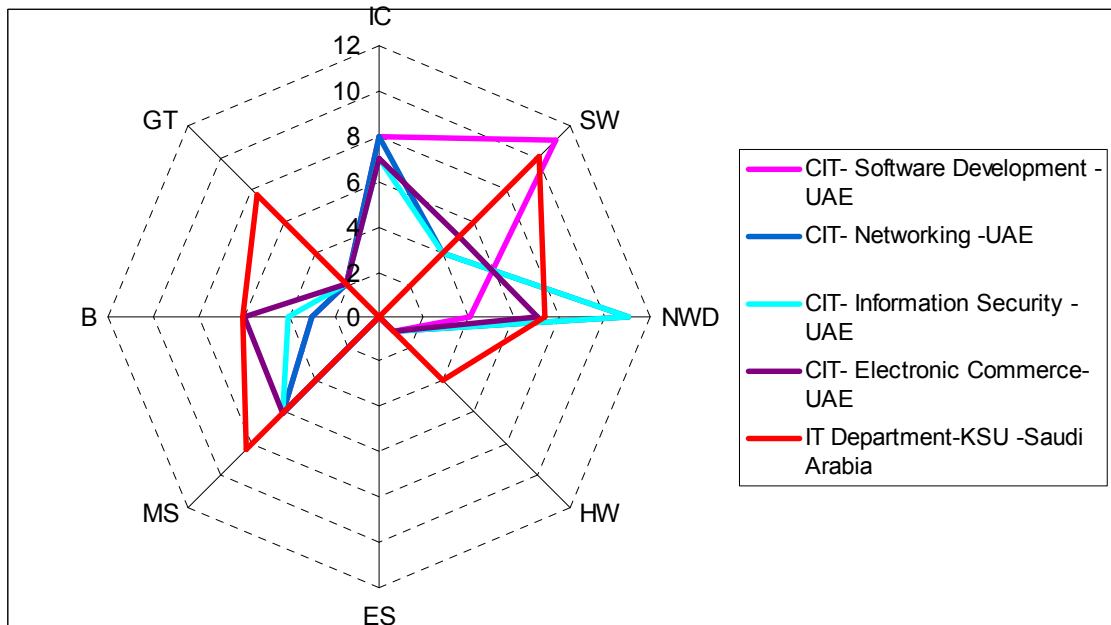
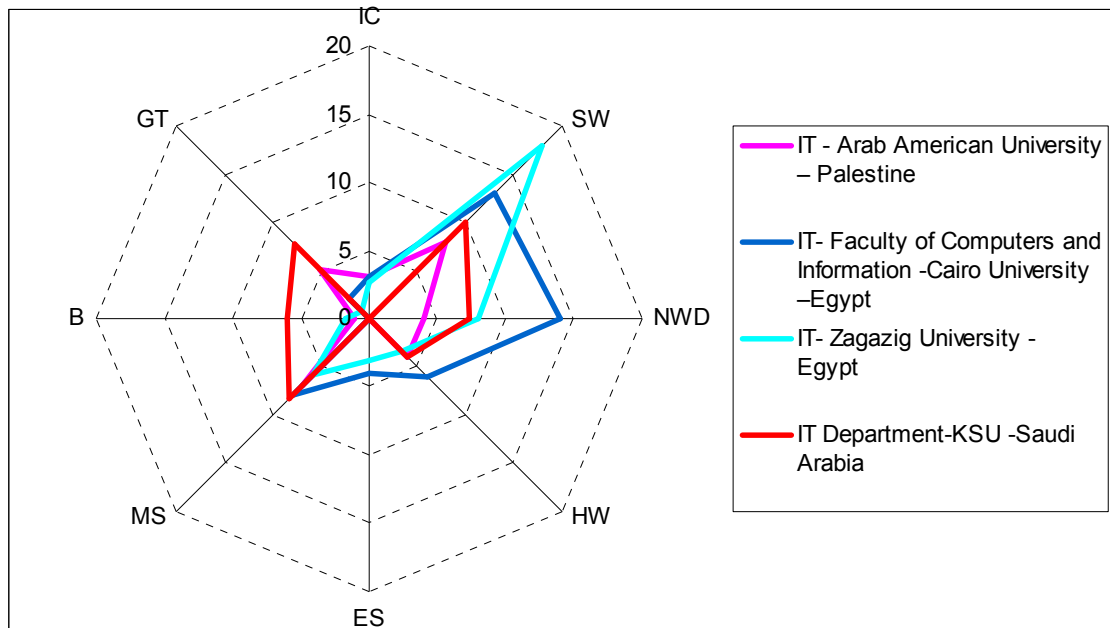


Figure 5.
IT in the Middle
East



Moreover, the tie shape that our program has demonstrated in previous figures means that there is an apparent lack in some areas of our program, namely: IC subjects. This confirms our findings of the comparison with ACM recommendations where we reported that HCI and Social and Professional Issues were poorly covered. This tie shape is common in other IT programs offered in Saudi Arabia as seen in Figure 2.

It is also clear that our program has the highest MS and B content and the second highest HW content (only Cairo University has more). This observation indicates that our academic program offers many subjects that are not directly related to the body of knowledge required by any typical IT program, it also gives us room to exchange some of the course in those areas to missing courses in the IC area.

Next we compare our IT program against international programs. To make the diagrams easier to read, we grouped US programs in Figure 6, and UK and Australian programs in Figure 7. Again our IT program is plotted as a red line in both diagrams.

A first glance at the diagrams shows some interesting findings. It clearly shows that there is no tie effect and that all programs have proportions in each subject area, except in the case for our IT program.

Another interesting result from comparing these two diagrams is that the classification system used favors of the US programs as it shows a uniform star oriented shape with contrast to the UK/Australian programs which take a non-uniform star shape. This may be due to the fact that the subject classification system used in this study is based on an American study for comparing US programs (Lunt et al., 2002).

Moreover, the two diagrams reveal an interesting finding with regards to how close we are to either group of programs. It clearly shows that we are more oriented towards the US than the UK IT programs.

Finally, the distribution in US programs compared to UK and Australian is more uniform (they tend to have the same shape) especially towards the B, GT, MS, and HW axis. However the UK and Australian programs spark towards B, or SW. This may be due to the different higher education paradigm in the US and UK and Australia, the former tend to focus on broad knowledge whereas the latter focuses on specification.

Focusing on Figure 6, it is clear that our IT program is in close proximity to the majority and has reasonable units in MS, GT, B, SW, NWD subjects. However, it also shows that our program clearly lacks IC units.

Figure 6.
IT in US

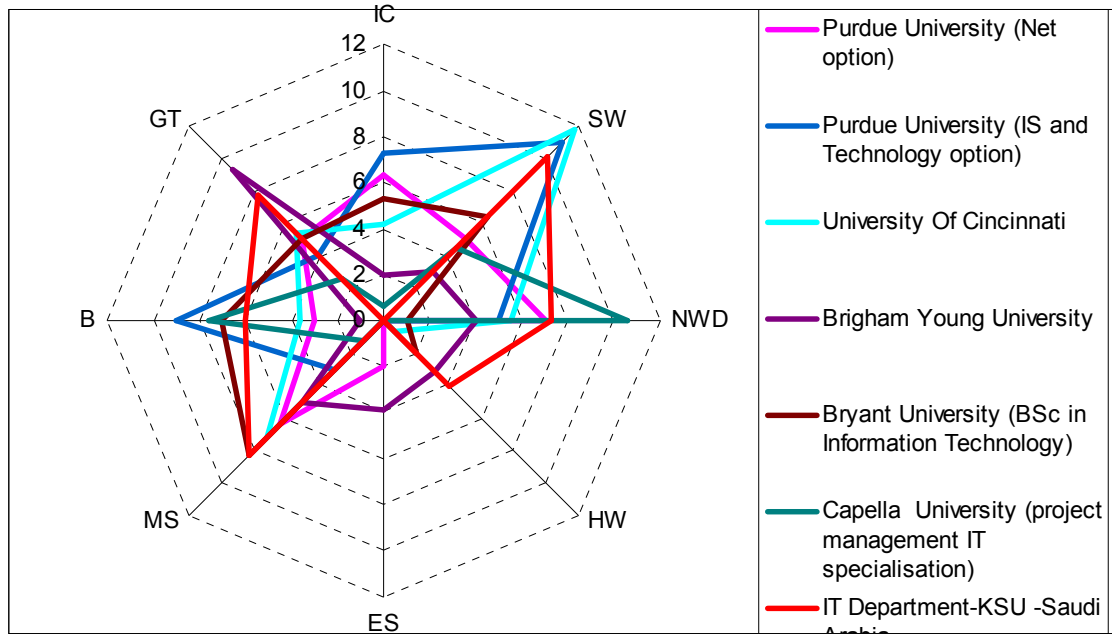
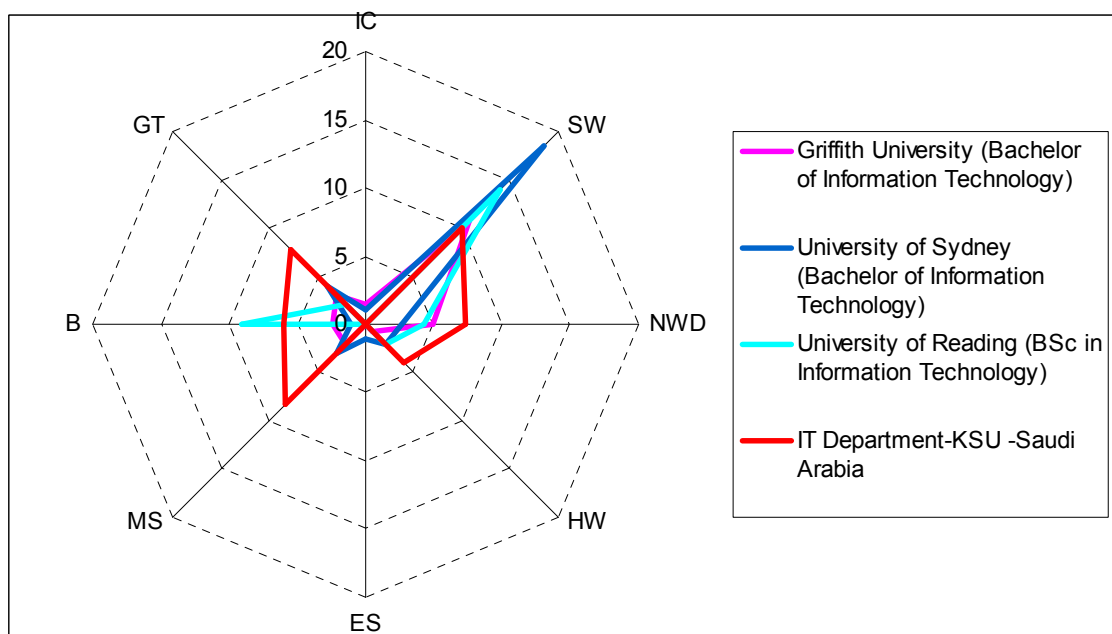


Figure 7.
IT in UK and Australia



A first glance at Figure 7 shows that, although in different proportions, all programs tend to spark towards SW except for the University of Reading which sparks towards B as well.

With regards to MS, NWD, IC, GT and HW they all seem to overlap (in close proximity), which means they have relatively equal units in these subjects except for our IT program. Focusing on our IT program, the diagram shows that there is no spark towards any one specific subject and that means there is no focus or specialization on a specific area compared to other programs. In addition, our program places more focus on MS and GT units and clearly lacks IC. Moreover, the values of B, SW, and NWD in our program are in close proximity to other programs which indicates that the coverage of these subjects in our program is similar to UK and Australian programs.

Recommendations and Conclusion

This paper has presented a preliminary evaluation of the IT program offered by the college of Computer Science and Information System at King Saud University. The evaluation framework is based on previous studies in this field and tackled three levels of evaluation, namely: national and Middle Eastern programs, international programs and international standards.

Our empirical comparison with the various programs and the resulting radar charts shows that our program is missing Interpersonal Communication content, therefore the tie shape. It was interesting to find the same shortcoming in the other Saudi Arabian programs.

Another finding from the program comparison is that programs with specific tracks or concentrations exhibit sparks in their radar charts. No such sparks are found in our program which only assures the importance of moving towards implementing different tracks as planned in the near future in order to get to higher standards equivalent to those of international programs.

We also saw that we have a high content of business oriented courses; this can be used as a stepping stone towards developing a business oriented track in the future. It may also give us the opportunity to exchange some of those courses to make place for other tracks while keeping IT related subjects in place. Similar arguments can be made with regard to the high content of Hardware oriented courses and Math and Science oriented courses. For example, if there will be a networking track, the high HW content is acceptable while the high business content is not necessary.

Obliviously, our analysis is critically dependent on the validity of our classifications of the different programs. Moreover, the analysis did not take into consideration the comparison of subjects' content, thus giving us a new direction for future analysis.

Finally, our comparison with ACM recommendations has shown that we are missing some important subjects in our program. Among them are: HCI and Professional issues

and Ethics. During the collection of the information for that part of the study, many instructors indicated that there were a lot of topics that were not mentioned in the Information Technology Body of Knowledge. In general that is typical since the core only covers 16% of a complete program, so indeed it should be that way. With careful review of the department's course contents it is very much possible to include most of the uncovered units that were mentioned in Table 5. Although including the required HCI hours will be a challenge.

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