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An Open-Buffet Education Framework Addressing IT Undergraduate Disciplines

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Abstract

Computing and Information Technology (IT) skills became more and more desirable for many disciplines. However, the IT background given in the current educational systems is often insufficient for the disciplines such as, Communication and Media Studies, Education, Economy, Business etc. This paper propose an effective and economically feasible trans-disciplinary educational framework where the graduates from the Information Technology department, fully proficient in basic IT skills such as data collection, data processing, data management, IT system analysis and IT system design; would have a successful carrier in many disciplines in the industry or they would continue their graduate education in non-IT disciplines.

Key Words: IT Skills, IT Curriculum, IT Curriculum Development, Trans/Multi/Inter-Disciplinary Education.

1. Introduction

In every sector of the world economy, the need to employ Information Technology (IT) literate people increases as the world is entering deeper into the Information Age. This tendency resulted in a growth in IT related occupations [1] and yield an increased demand for IT professionals and IT literate subject specialists [2,3]. "The number of workers in the computer and software industries has almost tripled in the past decade" [4].

In the new business environment, the boundary between business and IT becomes blurred. However, yet, the skills of non-IT discipline graduates, such as business, do not significantly overlap with those of IT specialists [8]. Employing IT specialists in areas where professional skills are required, will hinder overall enterprise performance (i.e. business, operational and infrastructure performance) due to insufficient level of subject-specific skills of the IT specialists [9,10]. IT professionals that aim to get promoted in their companies need to develop communication, business processes, strategic planning, professional and technological skills. Hence, to adapt to the fast pace of digital transformation, a need to subject specialists with high level of IT competency arises. Since the current curricula and educational systems do not fully satisfy such a set of skills in their graduates, a new flexible trans-disciplinary education framework to graduate students with sufficient level of IT

specialization and professional skills as well as, the necessary skills required by the industry, must be designed.

This paper is organized as follows: Section 2 describes the set of skills required for a successful carrier in an industrialized society. In section 3, background about the generic issues in multi/trans/inter-disciplinary education framework to satisfy the needs of the industry and further education, is exploited. Section 4 briefs the structure of the proposed curriculum and the alternate educational tracks offered by the proposed framework are detailed in section 5. The presentation of several case studies in section 6 is followed by important concluding remarks about the success of the proposed trans-disciplinary education framework.

2. Set of Skills Required For a Successful Carrier

The set of skills required for a successful carrier in IT or a related profession could be exploited in three different categories; *the soft skills, IT related skills and professional skills*. Each of these skills will be described in the following sections.

"An understanding of which skills are most important to new IT professionals should impact organizations at large, as well as the universities and technical schools that train future IT employees" [5].

2.1 The Soft Skills

These are the general skills required of every person employed in an IT-aware workplace. The soft skills include, but not limited to, reading, writing (using a word-processor), speaking (in one or more languages), and mathematics, presentation, team-work and communication skills [13]. "Universities should examine curriculum, particularly with respect to enhancing soft skill areas" [5].

2.2 The Specific IT Skills

The IT related skills can be listed as, hardware and software aspects of information systems, design and development of package software, use the soft skills and background IT knowledge in a problem solving capacity. IT related skills also include systems analysis; data collection, processing and storage; computer system and network security; graphical user interface and application program development; designing new solutions using IT and computer related hardware and software tools. IT specialists can also take on duties as

Database developer and manager, information system developer and operator, interactive digital media specialists, network specialist and technical support personnel for information systems.

2.3 The Professional Skills

These are the skills directly related to the major interest of the profession such as economy, banking, finance, accounting, inventory systems, medical sciences, law practice, educational sciences, architecture, business and administration, international relations, engineering etc.

The proposed trans-disciplinary education framework will be employed to grant the students with the soft skills, IT skills and professional skills listed above in order to satisfy the needs of the future professions in the industry or further education.

3. Background for Trans-disciplinary Education

Before exploiting different trans-disciplinary, multi-disciplinary, or inter-disciplinary education models and various application environments, it is necessary to define what a discipline is and how different disciplines are merged in order to form a trans/multi/inter-disciplinary education frameworks.

In [13], a *discipline* is defined as a particular area of study provided that it has unified tools, techniques and methods and a well developed jargon. Disciplines are said to develop into self contained hard-shells, which tend to minimize interaction with outside entities and other disciplines through the fiercely defended territories. Unlike many other disciplines, however, IT can not be abstracted from other non-IT disciplines. Since there is a great role of IT in every discipline, computer literacy must be considered as a necessary element of all the other disciplines.

There has been a trend to standardize education in some disciplines such as technology education [11] so that all students recruited in similar programs will be subject to the same curriculum. Such an educational model could be meaningful and sensible if all the students are being educated for the similar purpose, preferable in a local educational institute. However, in an international university, such as EMU [21] where students from all around the world are recruited in the programs of study, such a standardized education will be a limiting factor on the versatility of the graduates and hinder their future carrier prospects.

A diversity of educational institutions have been developing different educational frameworks such as multi-disciplinary [12,

], inter-disciplinary [15,1

or trans-disciplinary [13] education in order to satisfy the needs of the target sectors in the industry or in further education. However, none of these frameworks, yet, significantly overcome the shortcomings of IT specialists about the lack of subject-specific skills or the lack of IT skills of subject specialists in professional positions.

"Multi-disciplinarity concerns studying a research topic not in just one discipline but in several at the same time" [6]. In the article by Callahan and Pedigo [12], a multi-disciplinary education model mixing the Information Engineering and Management disciplines has been introduced in order to fill the gap created by the shortage of executive level technical talents in the industry. In the article, the entire process from defining the objectives of an educational program to developing courses and managing a special group of executive students is covered in an educational model where both Information Engineering and Management education is offered simultaneously.

"Trans-disciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines" [6,7]. A trans-disciplinary master of engineering program is developed in [13] in order to establish a closer relationship between industry and educational institutions. They define trans-disciplinary education and research as a logical extension of inter-disciplinary and multi-disciplinary programs. The authors analyze the cases of managerial weakness of employees trained in engineering and technical weaknesses of employees trained in business. The method presented here also minimizes the interaction with other disciplines due to the disciplinary territories since the students enrolled in the undergraduate program should graduate before they can engage in this program.

The article by Maskell and Grabau [14], deals with a Multidisciplinary Cooperative Problem-Based approach to Embedded System Design. The course is taught with a Problem-Based-Learning (PBL) scenario, to the second year undergraduate students coming from different degree programs. In this model, multiple disciplines are presented to the students simultaneously.

In the article by Doom, Raymer, Krane and Garcia [15], a baccalaureate computer science option is introduced to Bioinformatics, which is multi-disciplinary itself by nature. However, this educational model is limited to two disciplines only.

Inter-disciplinarity, "concerns the transfer of methods from one discipline to another" [6]. The article by Ivins [16] studies the inter-disciplinary project work involving the engineering

and design disciplines focusing on the experience of working in multi-disciplinary project teams to provide valuable encounter with the "real-world" pressure of delivering a product and foster a respect for the demands, and capabilities, of other disciplines and their role in the process of product design. The article also presents what the members of different disciplines think about members of other disciplines before (pre-project) and after (post-project) working together in a multi-disciplinary project environment and how they are freed from their prejudice.

Báez-López and Montero-Hernández presents [17] an inter-disciplinary electrical and computer engineering curricula, which allows students to get a knowledge of the different disciplines within engineering practice, such as mechanical, systems, civil, industrial, chemical and food engineering. Metaxas and Ribner [18] wrote their experiences about an inter-disciplinary course where art and computer science students worked in assigned pairs to produce an interactive multimedia project.

All of the methods proposed by the above articles [9, 12-1

, 19] suggest cooperation between a limited set of disciplines in the duration of the actual work done. However, the method proposed in this article is a generalized framework for multi-disciplinary, trans-disciplinary and inter-disciplinary education, which should, at least in principle, cover all options and lead the way to any available track after building a firm IT background.

In this article, a versatile educational model for trans-disciplinary education is proposed, in which, the IT related skills are given to the students and the professional skills are then developed as the students choose any one of the optional tracks available in the current department or the other departments within the same university or elsewhere. A similar study was done in [20] for different tracks within the Information Technology discipline itself. However, the industry needs more than that these days and therefore the idea should be extended to cover different disciplines.

4. Structure for the Proposed Curriculum

Most of the non-IT disciplines in current educational institutions have several IT-related courses at an introductory level in order to create an awareness of; digital communication systems; data collection, processing, storage and security issues. For example, all departments in Eastern Mediterranean University (EMU) [21] are giving an introductory IT course as a basic computer literacy background. As non-IT students from a variety of disciplines prepare to be the *information workers* of tomorrow, they must be able to use a

variety of rapidly changing computer systems and tools to solve an ever expanding range of problems across disciplines [22]. However, these introductory level courses do not satisfy the IT skills requirement in contemporary non-IT disciplines of interest in this article. When graduates are placed in the industry or in further education at M.Sc./M.A. (graduate) level, the lack of IT skills turn into a major handicap. Hence, if students from IT origin are enrolled in the Graduate programs in non-IT departments, it will result in a tremendous advantage towards fulfilling the missing IT skills requirement. However, these students will need to spend about a year before they complete the deficiency programs. In the education model proposed, we suggest to satisfy the need for the deficiency courses while the students are studying in the IT department.

As a case study, the Department of Information Technology (DIT) [23] in the EMU is considered as the test-bed for our trans-disciplinary education framework. Students graduated from DIT are fully prepared to enter the Graduate programs in any one of the departments of interest (they will be referred as target departments from here on) for further education.

Table 1 shows the proposed curriculum of DIT with reference to the courses required for completing the deficiency programs in the target departments. These courses are referred to as free elective courses. In the curriculum, DIT also have 3 non-major (non-technical elective-NTE) courses in the 2nd and 3rd years. Until the 3rd years, most of the students would have selected language or arts and sciences courses as NTE. But, those who are willing to gain more in depth professional talents required in many business, would not have selected any one of these courses. So, through the trans-disciplinary DIT curriculum, the students will have the chance of deciding their future carrier in further education and select the courses related to that target disciplines.

Table 1. Curriculum of the Department of Information Technology

		FIRST YEAR		
		Fall Semester		
EFL107 /117/127	35311	Communication in English I	(3,0)3	
ITEC101	35312	Computer Literacy	(2,2)3	
ITEC113	35313	Algorithms and programming Techniques	(3,2)4	
MATH111	35314	Basic Mathematics	(3,1)3	
GEED111	35315	Critical Thinking Skills I	(3,0)3	
TURK100/ TURK199*	35316	Communication in Turkish	(3,0)3	
GEED101	35317	SPIKE I	(0,0)0	S/U
		Spring Semester		

EFL 108 /118/128	35321	Communication in English II	(3,0)3		EFL 107
ITEC114	35322	Structured Programming	(3,2)4		ITEC113
ITEC164	35323	Introduction to Business	(3,0)3		
MATH161	35325	Mathematical logic of Computers	(3,1)3		MATH111
GEED112	35326	Critical Thinking Skills II	(3,0)3		GEED111
GEED102	35327	SPIKE II	(0,0)0	S/U	

SECOND YEAR

Fall Semester

ITEC165	32331	Basic Economics	(3,0)3		ITEC164
ITEC225	35332	Internet Programming	(3,2)4		
ITEC243	35333	Object Oriented Programming	(3,2)4		ITEC114
ITEC255	35334	Computer Organization & Architecture	(3,1)3		
NTE	35335	Non Technical Elective(Physical/Natural Sciences)	(3,1)3		
GEED201	35337	SPIKE III	(0.0)0	S/U	

Spring Semester

ITEC202	35341	Operating Systems	(3,2)4		ITEC255
ITEC212	35342	Database Management Systems	(3,2)4		
ITEC226	35343	Internet Applications	(3,2)4		ITEC225
NTE	35345	Non Technical Elective. (Arts/Humanities)	(3,1)3		
TE	35346	Technical Elective	(3,1)3		
GEED202	35347	SPIKE IV	(0,0)0	S/U	

THIRD YEAR

Fall Semester

ITEC309	35351	Computer Networks	(3,2)4		ITEC202
ITEC313	35352	Database Programming	(3,2)4		ITEC212
ITEC333	35353	Systems Analysis	(3.2)4		
MATH211	35354	Introduction to Statistics.	(3,0)3		
FE	35355	Free Elective*	(3,1)3		
GEED301	35356	SPIKE V	(0,0)0	S/U	

Spring Semester

ITEC312	35361	System Programming	(3,2)4		ITEC202,
ITEC314	35362	Multi Platform Programming	(3,2)4		ITEC243
ITEC334	35363	System Design	(3,2)4		ITEC333

FE	35364	Free elective*	(3,1)3	
NTE	35365	Non Technical Elective (Social/Behavioral Sciences)	(3,1)3	
ITEC300	35366	Summer Training	(0,0)0	S/U
GEED302	35367	SPIKE VI	(0,0)0	S/U
		FOURTH YEAR		
		Fall Semester		
ITEC421	35371	Management Information Systems	(3,1)3	
TE	35372	Technical Elective	(3,1)3	
TE	35373	Technical Elective	(3,1)3	
FE	35374	Free Elective*	(3,1)3	
FE	35375	Free Elective*	(3,1)3	
ITEC401	35376	Graduation Project Orientation	(0,1)0	S/U
HIST200/ HIST299	35377	History of Turkish Reforms	(2,0)2	
		Spring Semester		
TE	35381	Technical Elective	(3,1)3	
FE	35382	Free elective*	(3,1)3	
FE	35383	Free elective*	(3,1)3	
FE	35384	Free Elective*	(3,1)3	
ITEC402	35385	Graduation Project	(3,0)3	ITEC401

*: the free elective courses are designed to fulfill the deficiency program requirements of the target graduate departments or industry.

Table 2 shows the Business and Management Courses while Table 3 shows the Mathematics courses in the DIT.

Table 2. The Business and Management Courses in DIT

ITEC 164	Introduction To Business
ITEC 165	Basic Economics
ITEC 421	Management Information System

Table 3. The Mathematics courses in DIT

MATH 111	Basic Mathematics
MATH 161	Mathematical Logic for Computing
MATH 211	Introduction to Statistics

The courses in the curriculum are distributed among 5 categories, namely the departmental courses, technical elective, free elective and non-technical elective and General Education courses. The proportion of each category is given in Table 4 below. From the table, it can be seen that, the number of GE* courses is 18, departmental IT courses is 18, technical elective courses is 4, free elective courses is 7, and non-technical elective courses is 3.

Table 4. Distribution of courses of DIT

General Education Courses	18 (including spike, Turkish, History, Critical Thinking Courses)
Departmental IT Courses	18 (including summer training)
Technical Elective Courses	4
Free Elective Courses	7
Non Technical Elective Courses	3
Total Courses	50

The distribution of credits throughout semesters is given in Table 5. Total number of the DIT courses is 53 including the non-credit SPIKE, History, Turkish, Summer Training, Graduation Project Orientation and the Critical Thinking courses. However, the number of credit courses is limited to 40 with a total number of credits equal to 141.

Table 5. Distribution of Credits to semesters

FIRST YEAR	
Spring Semester	19 credits
Fall Semester	16 credits
SECOND YEAR	
Spring Semester	20 credits
Fall Semester	18 credits
THIRD YEAR	
Spring Semester	19 credits
Fall Semester	19 credits
FOURTH YEAR	
Spring Semester	17** credits
Fall Semester	15** credits
TOTAL	141 credits

**: *The total credits in the final year is intentionally less than the other years to create students the opportunity for industrial visits towards development of their graduation/group projects.*

In the 21st century, students with different ethnic background, language skills, goals, and motivations are gathered in the same classrooms [24]. EMU, in general, is a multinational and multilingual education environment. The DIT, in particular, has a high proportion of international students which are keen on taking on responsibilities in the IT related industries or continuing their education towards Graduate in different disciplines to be more competitive in their future carriers. Since they have different goals in their future studies or life, they have interests in different subjects such as Communication and Media Studies, Business, Tourism, Accounting, Education, etc.

* The GE courses are the university core courses including language, arts, humanities, social and behavioral sciences.

During undergraduate education, by the means of the free-elective courses, students are given the chance to complete the required deficiency program courses that are necessary for further education in the target departments. Hence, the IT graduates will be easily placed to the Graduate programs of the target departments. The proposed system is also well accepted by the target departments [21] as well as the IT related industries.

5. An Alternate Tracks Offered By DIT

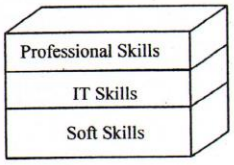
The trans-disciplinary education system proposed in this article is divided into specific tracks depending on the aims of the students enrolled. The main tracks available are classified as either industry or further education tracks. Students choosing the industry track will aim to work in many *professional* fields in the industry such as, IT, Information and Communication Technology (ICT), media design and applications, Radio-TV broadcasting, journalism, banking, economy and the like. On the other hand, students choosing the further education and research track may continue education in Information Technology/Information Systems, ICT, Communication and Media Studies, Radio and TV Broadcasting, Journalism, Banking, Finance, Economy, etc. The free elective and technical elective courses will be chosen in accordance with the selected track under the advice of the students academic advisors.

Many scientists argue that IT is not suitable for scientific research but it is merely an application field [25] while others claim suitability of IT for research towards Graduate and Ph.D. degrees [26]. The authors of this article share the worries of [25]. However, these days, many universities with high reputation are known to offer Graduate and Ph.D. programs in Information Technology (IT) or Information Systems (IS). Yet, some universities offer M.Sc. or Ph.D. in Computer Science (CS), but they make research in IT/IS subjects as well as CS [27]. Hence, based on these material facts, we included further education in IT/IS/CS as one of the tracks.

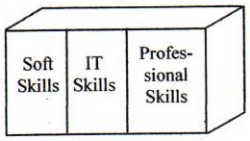
The method we propose works successfully since the educational activities themselves are augmented by the existence of the IT skills gained before they start *professional* education. The time and stage of transition from IT education to professional education can be adjusted depending on the needs of the selected track.

By playing with the boundaries, the trans-disciplinary education framework can be established in numerous ways, depending on the educational objectives and learning outcomes. Figure 1, which is the vertical model, currently employed in many well known

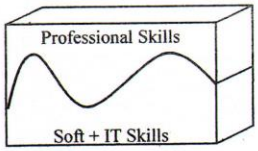
universities; suggest that the students graduate from one discipline before they are enrolled in another. This model, which is shown in Figure 1.a conforms to the definition of self-contained, hard-shells, disciplines in [13], which tend to minimize interaction with outside entities and other disciplines through the fiercely defended territories.



a) The vertical trans-disciplinary education model with fiercely defended boundaries



b) The horizontal trans-disciplinary education model with fiercely defended boundaries



c) The vertical overlapping disciplines model of trans-disciplinary education with fuzzy boundaries

Figure 1. Several ways of establishing a trans-disciplinary education framework.

The horizontal model employed in many disciplines such as [12,14,15] is shown in Figure 1.b. In this horizontal model of trans-disciplinary education, students are introduced the opportunity to gain all of the soft skills, IT skills and professional skills simultaneously. Various types of vertical or horizontal trans-disciplinary educational models, where percentages of IT plus Soft Skills and professional skills are controlled can be formed depending on the objectives and the learning outcomes. This is depicted in Figure 1.c.

The problems encountered in the vertical and horizontal model cases mentioned above could be solved by constructing an overlapping disciplines vertical model, where the final two years curriculum of the undergraduate program is modified to include the courses in the deficiency programs of the Graduate programs the students are aiming. The diagram in Figure 1.c shows the details of this model.

Non-IT discipline courses will be taught by the instructors of the related departments, such as ECON101 will be taught by the Department of Economics. This will provide a foundation for continuous learning, providing an understanding of how IT can be used in complex domain-specific problem solving in various disciplines [28]. Case-studies must be done in order to satisfy the needs of the target department curriculum. Students see how professionals from different disciplines use IT to solve problems. Also, students will learn to use software tools in the laboratory practice hours, for solving problems in various disciplines (accounting programs, web-based instructional design programs, etc.).

By the means of the courses taught in DIT, such as systems analysis and design, project management and graduation project, the students will build a strong background in topics such as project planning, project scheduling, team management, organizational behavior, communications, risk analysis, and quality management. These topics cover the cases that also exist in different disciplines like business management, hotel management, and Management Information Systems. Also when the term projects and graduation projects are prepared, students will be concerned with real life business problems. Then, the students will be able to understand the real life problems in different disciplines and be able to produce solutions for them in a team-work environment. These trans-disciplinary courses that are taken as free-elective, will help them to abstract the business information and relate it to their IT background. These are the important points that support the need for trans-disciplinary education.

The departments considered for the vertical trans-disciplinary education framework case studies are presented in the next section.

6. Case Studies: Selecting Different Tracks

Students are given the chance to know and choose any one of the available tracks during their undergraduate education in the DIT. By then, they would have finished gaining the soft skills, the basic IT background and an understanding of the trans-disciplinary education concept. Students will make a choice for their future carrier depending on their capacity in basic skills (language, speaking, reading, writing, presentation, mathematics, etc), analytical and theoretical skills, their capabilities in practical project development, suitability to team work etc. Those students who are better in practical work than theoretical may choose the industry track while those students with stronger analytical and theoretical background may

prepare to choose the further education track. These available tracks and requirements for each track are described in detail in the following section.

6.1 The Industry Track

The proposed educational framework enables those students who are interested in taking on responsibilities in the IT or related industries, to nurture themselves in order to satisfy the industry's needs through the means of the free elective and technical elective courses. The critical skills factors required by the IT or related industries, investigated in [29,30,31] can be listed under 5 categories, namely the:

a) *Business Knowledge*: Knowledge of business environment and functions; ability to interpret business problems and develop appropriate technical solutions; knowledge of specific industry (retail, manufacturing, financial etc.); ability to plan, organize and lead projects, write technical manuals, documentation and reports.

b) *Advanced IT/IS Applications*: Electronic commerce; expert resource management systems; customer relations management systems; decision support systems; knowledge management systems and executive support systems.

c) *End User Education and Support*: End-user computing support; help desk/information centre; ability to work closely with users and maintain positive user or client relationship.

d) *Programming*: Software applications development and selection; database modeling and development; programming/CASE tools.

e) *System Planning*: Hardware acquisition (evaluation and selection); systems analysis: information systems planning, management and evaluation; information access, data protection and security.

The educational framework proposed in this article provides the list of necessary courses which are very closely related to developing the talents required by the industry. The snapshot in Table 6 is a typical list of courses a student in the industry track can choose from.

Table 6. Typical list of courses in the industry track

E-Commerce Applications
Information Systems Security
Multimedia Applications
Expert Systems
Server Side Programming
Network Management

Graphical User Interface Design
Application Development Project Management
Web Project Applications
Advanced Topics in DBMS
Data Warehousing and Data Mining Applications
Object Oriented System Design
Programming with Java
Applied Animation Techniques
Client-Server Computing

6.2 Further Education Track

A sensible way of providing the desired flexibility into the DIT curriculum is through introducing a number of free-elective courses. The aim of the free-elective courses is to satisfy the deficiency program requirements so that, the DIT graduates can further their education in one of the target disciplines and indulge in a trans-disciplinary education framework. This can be very easily done by inserting 3 non-technical elective courses and 7 free-elective courses into the DIT curriculum shown in Table 1. The number 7 is chosen such that all of the deficiency programs in the cases at hand will be satisfied. With 7 free-elective courses, a student has the opportunity to switch from IT education to any one of the many possible target professions in the industry or target educational programs.

The target disciplines chosen for further education are the ones that most need IT knowledge and have educational aims in parallel with IT. In addition, the DIT students often prefer these departments for further education after graduation. Hence, the departments proposed for being the cases for trans-disciplinary education in IT are Information Systems, Business Administration, Economics, Banking and Finance, Educational Sciences and Communication and Media Studies. The deficiency courses of these departments are integrated into the DIT's curriculum as free-electives, and the results of surveys and the success levels of students will be the outcomes of the proposal which is going to structure DIT's trans-disciplinary education framework for future studies.

By completing the deficiency courses, students will continue studying in the preferred masters programs according to the free elective courses chosen. By this selection, a student can have more than one choice for further education towards a master degree in any one of the departments listed below.

6.2.1 The Banking & Finance Department

The Banking and Finance Department in Faculty of Business and Economics is one of the departments of the EMU that leads to master degree. The deficiency program of the department is shown in Table 7. Since DIT students are taking the must course MATH211 (Introduction to Statistics), they will be exempted from STAT202. If they take the other 3 BNFN courses as non-technical electives, there will be no deficiency course left. So, there will be no extra semesters for taking deficiency courses in order to begin the graduate program in Banking and Finance Department.

Table 7. Banking and Finance Department deficiency program courses.

STAT 202	Statistics
BNFN 303	Essentials of Corporate Finance
BNFN 312	Money and Banking
BNFN 302	Commercial Bank Management II

6.2.2 Economics Department

The Economics Department in Faculty of Business & Economics is giving master degree and the courses shown in Table 8 are the deficiency program courses. There are no courses that DIT students can be exempted. If the students take the 4 deficiency courses as free-electives, they will fulfill the deficiency course requirement.

Table 8. The Economics Department deficiency program courses

ECON 201	Intermediate Microeconomics
ECON 202	Intermediate Macroeconomics
ECON 315	Mathematical Economics
ECON 310	Econometrics I

6.2.3 Business Administration Department

Business Administration Department in Faculty of Business & Economics is giving masters degree and the five courses given in Table 9 are the deficiency program courses. There are no courses that DIT students can be exempted. If the students take the 4 deficiency courses as free-electives, they will fulfill the deficiency course requirement.

Table 9. The Business Administration Department deficiency program courses

ACCT 201	Introduction to Business I
MGMT 201	Principles of Management
MRKT 301	Marketing

ECON 201	Intermediate Microeconomics
FIN 301	Financial Management

6.2.4 Educational Sciences Department

Master program in Educational Sciences Department in the Faculty of Education has three deficiency program courses as shown in Table 10. The student eligible for master degree has to take these three courses which is one semester for deficiency courses. The students who take two courses as non-major electives can take the third course after being accepted to the graduate program.

Table 10. The Department of Educational Sciences deficiency program courses

EDUC 101	Introduction to Teaching Profession
EDUC 305	Planning and Evaluation of Instruction
EDUC 540	Development and Evaluation of Measurement Instruments

6.2.5 Communication & Media Studies

Communication & Media Studies masters program of Faculty of Communication & Media Studies has three deficiency courses as shown in Table 11. If the students take the 3 deficiency courses as free-electives, they will fulfill the deficiency course requirement.

Table 11. The Department of Communication and Media Studies deficiency program courses.

COM 101	Introduction to Communication Studies
COM 102	Communication in History
COM 205	Theories of Mass Communication

6.2.6 Information Systems

The Information Systems M.Sc. program in the Faculty of Arts and Sciences is giving masters degree in Information Systems. The program is a natural extension of the DIT education. Therefore, there is no deficiency course. Hence, as a further education track, students aiming for this program are automatically granted admission. The IS program could also be regarded as part of the industrial track as well.

7. Results and Conclusions

Many educational institutions do not fully obtain the required success level to meet the target learning outcomes for their graduates. Specially, at the beginning of the 21st century where almost all of the businesses are striving for information and information workers, the

need to hire IT specialists has reached its peak. More importantly, the need to professionals with IT specialization is even more severe. Hence, educational institutions must revise their curriculum for addressing these needs and introducing vertical trans-disciplinary education systems such that the students, at some stage of their education in IT or related departments, will switch from gaining soft skills and IT skills to gaining professional skills, depending on how much IT specialization is required in the future profession.

Free-elective courses can introduce the necessary flexibility into the curriculum so that students enrolled in the IT department will graduate fully prepared to enter workplace in the IT-related industry or Graduate programs of the professional departments such as Economy, Communication and Media Studies, Banking and Finance and Education.

The proposed educational framework ensures to preserve the qualities of IT education while providing the students with the opportunity to switch from IT discipline to other disciplines without wasting any time or extra effort.

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