Developing an Information Technology Model Curriculum

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ABSTRACT: *This paper explains the process and development of an Information Technology Model Curriculum by the College of Computer Science & Engineering at Taibah University, Saudi Arabia. The curriculum is based on the accreditation standards of the Accreditation Board for Engineering and Technology (ABET) and on the guiding principles of the ISO 2009 Curriculum Guidelines for Undergraduate Degree Programs.*

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1. Introduction

Through this study the process and development of an Information Technology Model Curriculum is explained and studied using a case study of the College of Computer Science & Engineering at Taibah University, Saudi Arabia. We use the accreditation standards of the Accreditation Board for Engineering and Technology (ABET). [1]

The process employed in developing as graduate program in Computer Science, Computer Engineering, and Information technology is intended to produce graduates who will be readily accepted in today's business and industry organizations [2]. The program is structured to meet up the requirements of business and industry. The first part of the paper will look at the important requirements of the curriculum followed by the course descriptions. Further we provide enhanced architectures that aid the implementation of the standard curriculum.

2. Important Aspects of the Course

In the literature on technology education, there is a focus on using outcome-based objectives to define graduating students. Such technology education is designed to build requisite knowledge, skills, and abilities in the student's primary focus area, and a graduate of this type of program should acquire specific sets of knowledge, skills, and abilities spread across the curriculum.

Computing and Information Systems, by nature, are practical and applied disciplines. These virtues and characteristics make this discipline more active than other discipline-based area of study. Such revamped programs, through differentiation between themselves from their competitors, have been successful in attracting new enrolments by fulfilling the needs of the students and by meeting their expectations (3, 4).

The course is intended to deal with all essential aspects of system design by giving the student the real-life experience of developing part of a system in a business or industrial environment. Additionally, group activities that enhance or develop

communications skills are highlighted. [5, 6] Activities that enhance or develop communications skills and professional and ethical issues are emphasised. The personal, interpersonal, and technical skills desired in the profile of a graduate are seen as a major issue.

2.1 Skills and Subject Area

Student of the new curriculum will be taught with the essential concepts that are needed to follow life-long learning. The curriculum document specifies, in detail, the required computing courses. [4] In addition to computing courses, there are a number of other essential courses, such as discrete mathematics, probability and statistics, and quantitative methods courses. It is evident that they are needed as prerequisites for several computing courses. Furthermore, general education courses, which should include social science, humanities, writing, and mathematics, are also critical. Below is the list of personal and general skills addressed in this curriculum:

- Leadership Skills
- Systemic Thinking
- Collaboration
- Communication Skills (Oral, Written)
- Analytical Thinking/Problem Solving
- Mathematical Foundation.

Another important aspect of the curriculum is represented by IS491 Group Research Project 1 and IS492 Group Senior Project 2, which is the follow-up to IS491. The project is intended to give students an authentic industrial and academic experience. After graduation, students are allowed to apply for grants to continue its project.

3. Related studies on Accreditation

The course accreditation by Accreditation Board for Engineering and Technology (ABET) requires an outcome based assessment and evaluation process whereby the program, its supporting courses and objectives are continuously refined based on constituent assessment [7]. Now the web based assessment is deployed in many schools such as The University of Bridgeport, which has developed an electronic web based assessment system that provides an assessment presentation website and course material website allowing the accreditation visitor to browse from the objectives and outcomes to specific course materials. Their method also provides course versus outcomes matrix and individual course grids [8].

There is an example of a web-based software system that facilitates an outcome-assessment process designed to meet their accreditation needs [9]. Some readily available programs stores data about courses and programs from university departments and generates a matrix of course versus outcomes for each academic major for accreditation [10]. The BlackBoard is a popular on-line Course Management Software (CMS) and it is extended further by many academic programs. Two such applications of integration are presented in [12]-[13]. In the integration a mapping exercise was further introduced in a study. [14].

A different implementation of the Web-based Course Information System (CIS) has enabled the administrative tasks arising with courses such as homework submissions and grades [15]. The studies reported in the literature have proved to meet the requirements of the students, faculty and university system as a whole. [16, 17] . We have surveyed the existing systems across countries and designed our curriculum design process. Before presenting the Taibah University framework, we have given below the course work descriptions.

4. Description of the Course work

The course is covered in two semesters. The course is divided into two parts:

a) The first semester is IS491 Research Project where the groups are required to focus on the analysis, planning stages.

b) The second part (semester two) is the IS492 Graduation Project which is the sequel of the IS491.

c) The project is intended to give the student a real industrial and academe experience. After graduation, the group is allowed to apply for grant to carry on their project.

Based on the brief description, we provide below the architecture of the coursework required for the curriculum accreditation. (Figure 1).

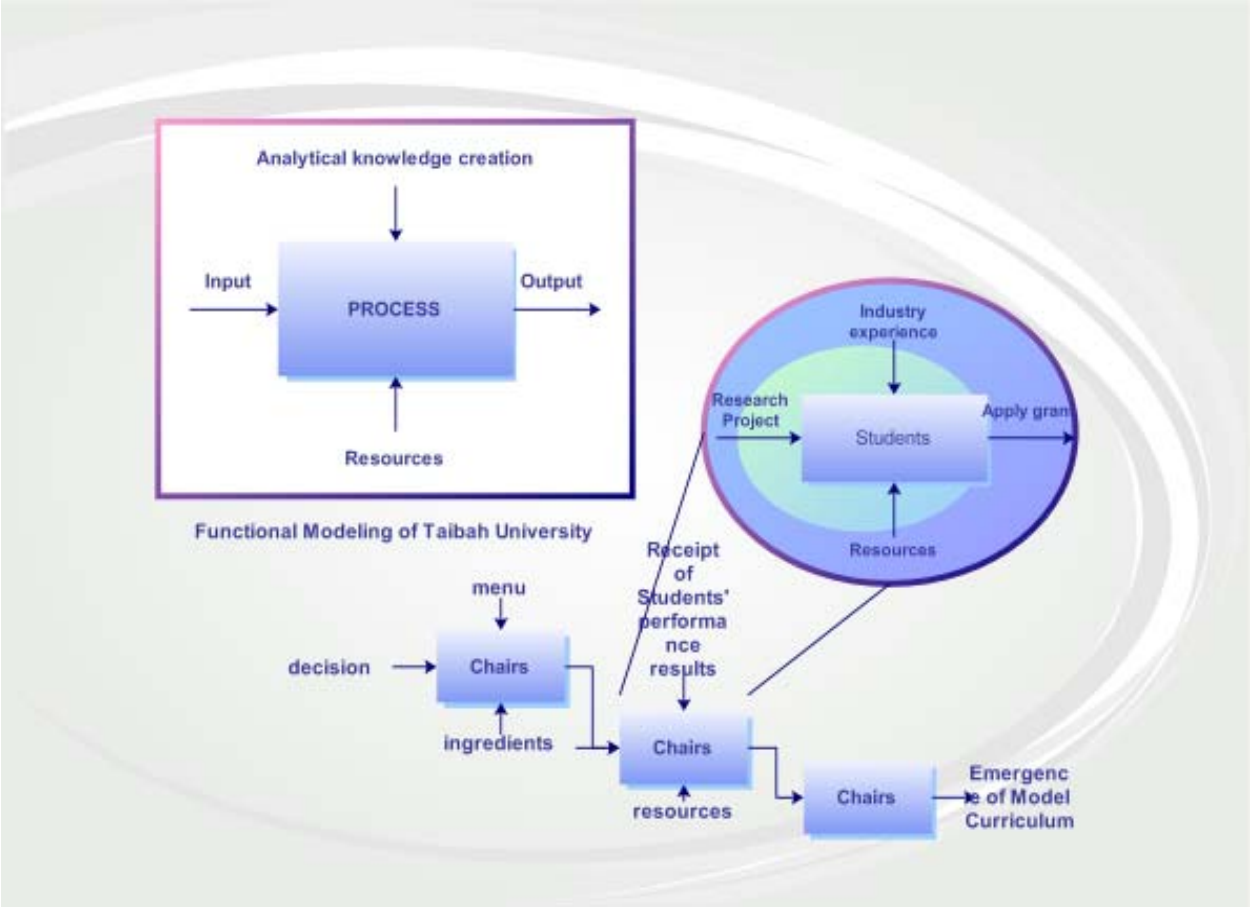

Figure 1. Coursework and its significance for a better rated Accreditation

The functional model of Taibah University includes many components such as Process, Students contribution and orientation of the Chairs and Faculty. The system managed includes analytical knowledge creation using resources both external and internal, student contributions such as projects, industry experience and resources exploitation. The Chairs and faculty use the students' performance, analytically compare available best practices and provide feedback. The combination of the analytical knowledge creation and student contribution leads to a successful emergence of model curriculum. This is considered as important as it ultimately leads to the ABET accreditation. Also, the system analysis view provides user interfaces to enter the mappings between Course Activities, Course Outcomes, Program Objectives, Program Outcomes, and ABET accreditation.

4.1 Quantitative Analysis or methods including Statistics

Quantitative methods have been shown to be tools which can be used effectively in the development of systems for course work and analysis and processing in complex domains of information technology.

The notion of quantitative analysis plays a more and more extensive role in the courses development. Indeed, most of the information technology management is based on the exchange of quantitative data. Many organizations and industries are sharing quantitative data with others, interfacing services from others, or outsourcing their ICT resources to various locations worldwide aided by the web. For all of them, the quantitative data becomes a cornerstone of their processes of collaboration, innovation and value creation. In this context, the information technology systems is moving towards the adoption of service-driven architectures where intra- and inter-organizational activities are carried out with the help of quantitative data services.

Quantitative data services are considered as a new means to deal with the complexity, modularity and interoperability of the constantly growing Information Technology. Design and development of data-driven architectures become key to the success of organizations and industries.

By realizing the significance given by ABET for quantitative data analyses, the Taibah University has evolved a suitable framework for ensuring the statistics content. The figure 2 represents the Taibah University framework of adapting ABET quantitative criteria for accreditation.

The input is arrived from the students' contribution of quantitative analysis basically. This exercise has been repeated through the means of Chairs and faculty feedback and correction. In this process students use both internal and external components of content. The chair ultimately takes decision for the implementation of the quantitative data analysis module. Once it succeeds the program will eligible for ABET accreditation.

The course has been unique in that it is specifically to meet the needs of business and industry. The curriculum was developed with feedback from academia and industry under a survey regarding undergraduate student's skills required in the Information System and Technology programme. It has been reviewed by a group of reviewers. The review led to some revisions.

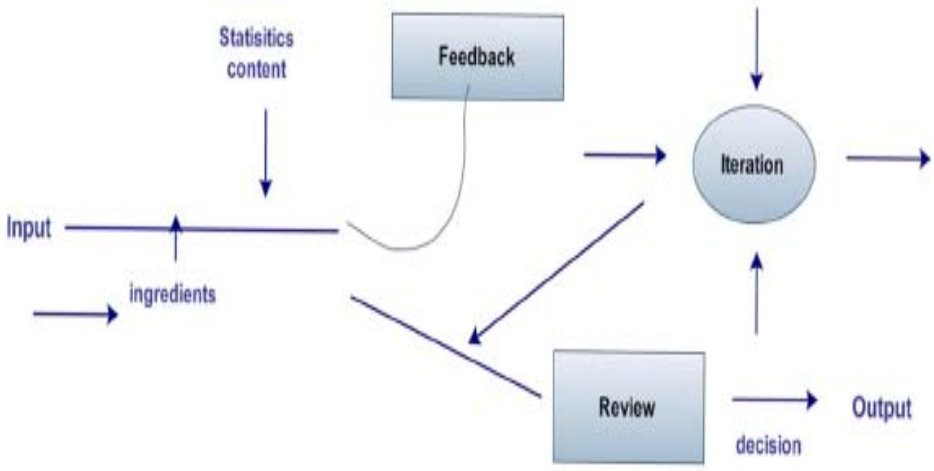

Figure 2. ABET Quantitative criteria for Accreditation

5. Facilities available -Tools, Equipment, Computing resources, and Laboratories available

The facilities available in the TU are expressed with features of browsing and navigation of the program. Students can navigate with the available tree structure which appears as the left side links of the Computing department of the TU courses page. The links are course information, program information, and the expected accreditation criteria. The target users are students, faculty, university authorities, accreditation system people and others. It is possible to find separate web links for Course Description, Course Activities, Course Outcomes, Program Objectives, and Program Outcomes, and accreditation requirements and the extend which the Taibah University system meets them. Besides, the relation among the various supported facilities is displayed as web pages in "Pop-up" window. Also, the system provides descriptive system information about tools, equipments, computing resources and laboratories the Taibah University has. For example, user can see the list of program outcomes supported by any course outcome and also view the vice versa. The relational links lead the navigators to find the courses, outcomes, or criteria and view all related information.

The brief description available in the Taibah University system includes the following.

a) Resources including institutional services, financial support, and staff (both administrative and technical):

b) Every project is supervised by a supervisor. Sometimes a supervisor can supervise more than one project at a time. The supervisor is required to meet his/her group once every week where he/she is required to evaluate students' projects in terms of quality. This means that the supervisors should not accept the submission of the final project before ensuring the quality of the project.

c) The group is given all possible support, for example, library or lab facilities, software and hardware, and credentials for meeting the industry or academia.

d) After graduation, students are allowed to apply for grant to carry on their project. This process depends on the outcome of

the project or the feasibility of the project; sometimes students are encouraged to apply for grant where they may develop further the project processes. But this is not always the case as the majority of the students start looking for career and this may lead them not to further proceed to their research interest.

The course description can be selected to display listed information describing course title, content, and credit. Further descriptive information includes prerequisites, textbook and other resource references. Also included are course overview and goals, course topics, and the faculty member who coordinates the course. This section also includes links to course activities and course outcomes. Figure 3 shows an example of a course description page in Taibah University.

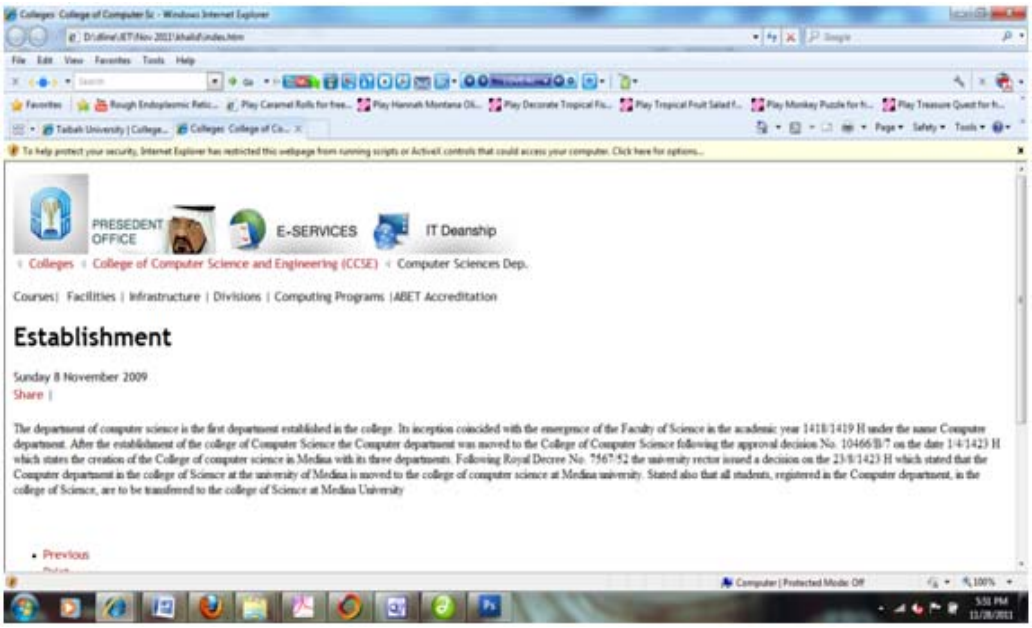

Figure 3. Course description page of Taibah University

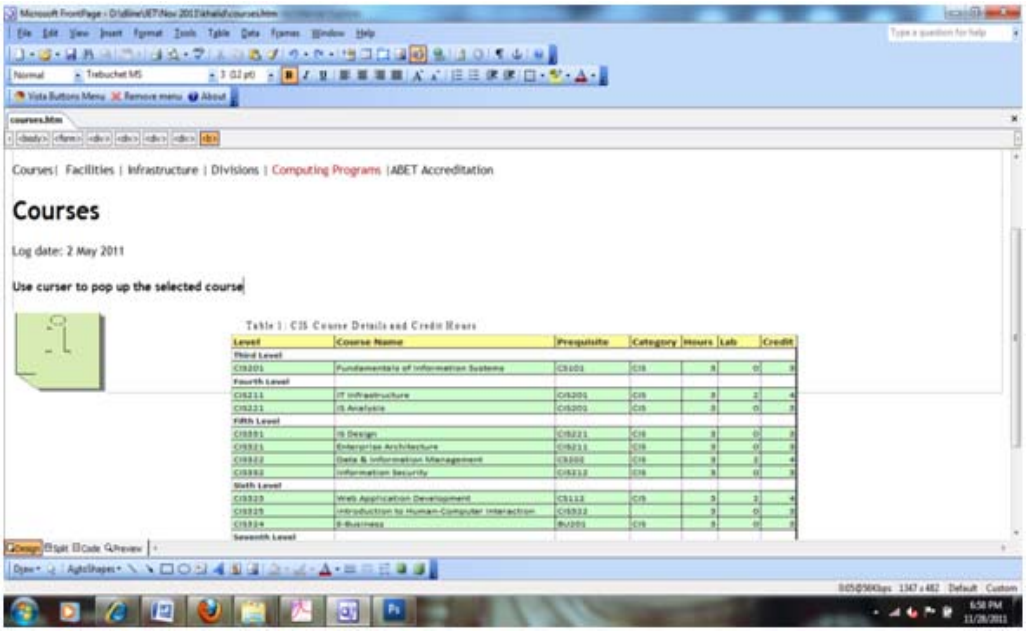

Figure 4. Course details information with the popup facility

Course activities provide information detailing sample graded work for the course. This may include information about exams, homework problems, quizzes, semester-long projects, and programming assignments. The course activities page includes links to course outcomes that are supported.

It is important to realise that, in addition to formal course outlines, many critical skills and performance criteria are incorporated throughout this curriculum and are expected to be a part of every course. The following requirements should be all encompassing throughout the curriculum:

The course details are available in the enumerated menu wherein each listed item of the course can able to provide information describing course title, content, and credit. In the same link or course description, more details such as prerequisites, textbook and other resource references are available. We plan to design the course overview and goals, course topics, and the students selected the course. This section also includes links to course activities and course outcomes. The Figure 4 provides the course details information with the popup facility.

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We also planned to offer the Program objectives in the proposed system, which also supports the students with a description of the goals of a program.

6. Conclusion

After developing and implementing our model for the University, we found that the courses hold considerable promise in attracting new cohorts of students besides enabling the accreditation. While implementing the designed program, the resources and facilities are also projected. A departure of earlier curriculum is that the infrastructure and computing facilities for practical work is called for. This is evident from the empirical system we have introduced.

The experiences we have gained lead to the discussions and solutions of the challenges and solutions. The systems with a strong curriculum designed will score over the prospective students willing to undergo computing courses. We plan to introduce newer aspects of the curriculum designing not merely for the sake of accreditation, but to bring the courses innovative.

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