# Online Education Experiences: Information Technologies Certificate Program at METU

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## ABSTRACT
This study presents IDE_A-ITCP, a Turkish nationwide Information Technologies Certificate Program, which is based on synchronous and asynchronous communication methods over the Internet, offered by cooperation of the Middle East Technical University Computer Engineering Department and Continuing Education Center. This online certificate program started in May 1998 and is still active with its 12th group of participants. The program includes eight fundamental courses of the Computer Engineering Department curriculum and is comprised of four semesters spanning nine months. The main aim of this program is to train the participants in the IT field to meet the demands in the field of computer technologies in Turkey. In the present study, the history, infrastructure, and educational aspects of IDE_A are discussed in detail.

## Categories and Subject Descriptors
K.3.1 [**COMPUTERS AND EDUCATION**]: Computer Uses in Education – *Collaborative learning, Computer-managed instruction (CMI), Distance learning.*

## General Terms
Human Factors, Design, Performance, Theory.

## Keywords
Computer Engineering Education, Online Education, Online Information Technologies Certificate Program

## 1. INTRODUCTION
The technological advances during the last half century have caused profound changes in the life styles of people around the world. The form and nature of human labor in the work force has taken its share from these changes. The expectations from the human capital have changed dramatically in the world of business. Harvey [1] stated that employers now seek graduates who possess personal attributes, such as intellect, ability to learn and self-confidence, as well as interactive attributes, such as communication, teamwork and interpersonal skills.. As a result, people are encouraged to learn coping with changes and demands in different aspects of their lives through training and learning. In today's rapidly changing world, adults cannot but be lifelong learners.

The higher education institutions and organizations in the developing world try to meet the needs of people by supplying the demand for a lifelong learning. Thus, technical training, graduate programs and certificate programs have been provided in many forms for the students, adults, and employees. Distance learning is one of the most convenient ways to offer these kinds of programs, since it inherently provides addresses the problems of availability -- in terms of accessibility and cost, and the demand for flexibility -- in terms of time, place and pace of learning [2,3]. Consequently, distance learning has expanded dramatically in the 1990s with the help of emerging technologies and this growth has continued in the new century. The number of new online degree programs and courses has noticeably increased. For example, in USA, over 3.9 million students were taking at least one online course during the fall 2007 term, a 12 percent increase over the number reported the previous year [4].

In Turkey, several courses and programs were delivered on the Internet at various universities such as METU, ITU, Sakarya, Fırat, İstanbul Bilgi and Ahmet Yesevi at the end of 1990s and at the beginning of 2000s. Middle East Technical University (METU) has started an experimental distance education course via the Internet in 1998. In the following years, METU developed and announced an Internet based distance learning certificate program (such as IDE_A-ITCP which is being investigated in this study), and an online M.Sc. degree program in Informatics (METU-ION) in which some lecturers of METU have started to offer their courses to the students through web pages. Sakarya University has started an online two years pre-BA program related to computer programming and information management. Istanbul Technical University established remote classrooms via a microwave link connecting its two campuses. Istanbul Bilgi University offered an e-MBA program (Online Master of Business Administration), which is an adaptation of a traditional MBA program using distance learning techniques and principles, in 2000. Fırat University has broadcasted some educational programs on Fırat RTV. Ahmet Yesevi University has been offering some distance learning programs via the Internet, including programs in the area of management (graduate and post-graduate), management information systems (graduate and post-graduate), computer engineering (graduate and post-graduate), and computer programming (two years program) [5]. Currently, a large number of courses and programs (especially graduate courses and programs) are being offered over the Internet in many universities in Turkey. In the current study, we present IDE_A-ITCP program offered by METU in the area of information technologies.

## 2. ONLINE ITCP
The online Information Technologies Certificate Program (IDE_A-ITCP) is one of the first Internet Based Education Projects of METU, which was launched in May 1998. It is based on synchronous and asynchronous education over the Internet, and is offered by the Computer Engineering Department at METU. The courses are taught by the instructors from the same department. Even though the language of instruction is English within the university education, because of the audience IDE_A-ITCP targets, Turkish course materials are prepared by the instructors for IDE_A-ITCP and Turkish is used as the language of instruction. The main aim of the online ITCP is to train

participants in the IT field to meet the demands in the field of computer technologies in Turkey. Furthermore, the online ITCP provides opportunities for the people who do not have access to traditional education in information technologies or computer engineering, but who are interested in this area, who would like to improve themselves in this area and desire to make progress in their existing career [6].

The program provides online lecture notes, learning activities and visual aids, and each course has a textbook to follow. An instructor and two teaching assistants are assigned for each course. In order to provide interaction between instructors and participants, and among participants, each course utilizes e-mail and discussion lists and chat sessions through a learning management system based on Moodle-LMS [10]. At the end of each term, there are face-to-face sessions for each course, taking place within the METU campus. For each course, at least three or four assignments are given to the participants during the semesters. At the end of each semester, there are traditional final examinations given during the on-campus sessions. The participants' final grades are based on the final examinations, assignments, attendance to chat sessions and discussion lists, and on-campus project presentations if applicable. At the end of the program, successful graduates receive an official certificate approved by the president of the METU, the chair of the Computer Engineering Department, and the president of the Continuing Education Center.

## 2.1 Description of the Courses in the ITCP

In this program, eight courses given in four semesters are as follows:

*Computer Systems and Structures:* The main aim of this course is to give an introductory level of knowledge on software, equipment and structure of computer systems. Central processing unit, memories, input/output principles, environmental tools, such as printers, operating systems, general application software, programming languages, and also files, file systems, data transfer are handled throughout the course.

*Introduction to Computer Programming with C:* The main aim of this course is to teach the basic computer programming concepts using the C language, to students who may have no prior programming knowledge or experience. The course makes have use programming examples and practical applications. At the end of the course, students are expected to be able to write basic C programs and analyze or modify existing source code. Some topics of the course are as follows: variables, operations, conditionals, loops, and arrays.

*Data Structure and Algorithms with C:* The main aim of this course is to teach basic data structures and algorithms concepts. The aim of giving these basic concepts is not only using them in solving the examples and exercises presented during the course, but also being able to use or extend them for building feasible solutions to other programming problems. The course content spans general programming strategies and specific data structures and algorithms, including: pointers, lists, trees, and searching and sorting algorithms.

*Operating Systems with Unix:* The main aim of this course is to form the theoretical basis about operating systems and to teach UNIX as a multi-user operating system. Bash is taught as a scripting language to perform automated tasks. This course tries to prepare the students that may pursue a more system administrative career.

*Software Engineering:* Software development projects generally make use of concepts and methods developed in the areas of Management Sciences, Systems Engineering, and Software Engineering. This course bears the goal of teaching these concepts and methodologies necessary for the design, analysis, development, and testing of software systems.

*Database Management Systems:* The main aim of this course is to teach relational database modeling, structured query language (SQL)database design and the use common database management systems..

*Web Programming:* The main aim of this course is to teach web programming concepts and introduce recent web technologies, such as, web servers, MySQL, PHP, DHTML, XML, XSS, and Java.

*Software Development Project:* The main aim of this course is to get the students improve and consolidate the concepts and techniques they've learned in the frame of software development project and obtain experience in a large scale software project. Students work in teams to develop a software product for a problem of their choice and document the design and development processes using the reporting standards commonly used in software engineering.

## 2.2 Participants of the ITCP

Total number of students that have participated in IDE_A-ITCP between 1998-2010 is 1270. Figure 1 shows the number of participants for each academic year. Only undergraduate students and university graduates from 2- or 4-year programs have been allowed to attend the program for each year. Other expected characteristics of participants to be enrolled in the program are as follows:

- being computer literate
- having access to a computer with Internet connection and basic multimedia capabilities
- having an intermediate level of English (being able to understand what he/she reads)
- attending face to face courses and examinations, which are held at METU campus over two days in each eight-week semester
- sparing at least 6 hours for each course in a week

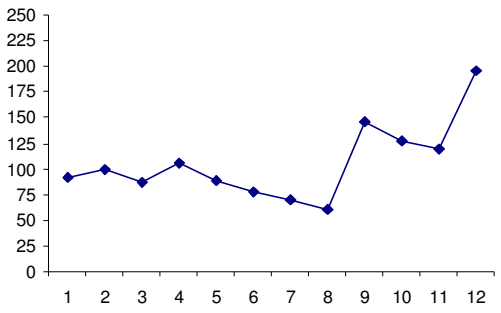


**Figure 1.** Number of participants from first program (1998-1999 academic year) to twelfth program (2009-2010 academic year).

# 3. LEARNING MANAGEMENT SYSTEMS IN ITCP

This certificate program has been constantly modified and updated since the first time it was designed. With the help of technological improvements, learning management system of the program has recently been redesigned. The current system is developed based on the Moodle-LMS [10].

## 3.1 Adaptation of Moodle LMS to ITCP

Up until the 2006 academic year, IDE_A-ITCP relied on a web site that was developed in-house and served on an IBM AIX server. The content of that web site was mostly static web pages, making its update and maintenance difficult and time consuming. Course discussion groups and assignment submissions relied on Perl scripts that used text-file based data storage. Although these scripts provided basic functionality for the courses, the integration between these different modules was lacking.

The online chats were based on Internet Relay Chat (IRC) protocol, requiring the participants to install an IRC client to participate in the chat sessions. As the businesses, internet service providers, and operating systems became more conscious of their network security, the firewall configurations started blocking the IRC protocol, causing students and our system administrators spend long hours on troubleshooting to work-around these problems.

To overcome these limitations of the old system, IDE_A-ITCP migrated to using Moodle LMS system, which meets the course content management, automation, and integrated data storage requirements. Moodle is an open-source system, making its customization and extension possible. It is written using mainly the PHP programming language, which is available for all of the major operating systems and web server environments. The data is stored in a database, allowing detailed analysis of student performance and participation.

In order to use Moodle in IDE_A-ITCP, several customizations and extensions were implemented. One of the main shortcomings of Moodle was that it could not handle multiple semesters for a course. We implemented semesters as different groups within courses, providing separation of program participants from each year. A new account management module was implemented to ease registration and participant identification within the system. A Content Management System (CMS) module was developed such as to allow Moodle to be used for both the public web site interface and the courses themselves.

The content for each course is delivered in an 8 week program. Each week includes a book module for the main content, an exercise module to allow the students to evaluate their comprehension of the topic and get automated feedback, and an assignment module that is graded off-line, in a semi-automated fashion by the teaching assistants. For programming assignments, an auto-grading module was implemented to ease the grading and to provide a uniform evaluation.

Communication among participants and instructors is achieved through discussion forums, instant messaging, and bi-weekly chat sessions. The Moodle chat module was improved to scale up to the IDE_A-ITCP participant numbers and provided via multiple network services to allow fall-back to the basic functionality for stringent client firewall configurations. The chat interface allows plain or formatted text input as well as drawings. The improvements implemented within IDE_A-ITCP were contributed back to the Moodle open-source project wherever possible.

In addition to Moodle access, each participant is given a Unix account to practice the Unix specific concepts taught in the Operating Systems course. The Unix account provides the ability to host user web pages, which is utilized in the Web Programming and Software Development Project courses. A database account is also provided to accompany the Database Management Systems course and database related projects that users may develop as part of their Software Development Project.

IDE_A-ITCP uses two dedicated servers to provide the above mentioned services. The servers are hosted on the METU high-speed network, which provides the best available speed and band-width access for the participants. These servers are continuously monitored and maintained by a single system administrator, with additional resources and support made available as needed from the METU Information Technology Division and the Computer Engineering Department.

## 3.2 Use cases of ITCP Components

The system has four main components: unregistered students, registered students, instructors, and system administrators. These components and their properties are represented as use cases in the Appendix.

# 4. EVALUATION OF ITCP

The program has been continuously evaluated according to user feedback since the implementation of its first design. Several studies, MS and PhD thesis were conducted to eliminate the program's deficiencies. For example, Yukselturk and Yildirim [7] examined participants' satisfaction level in the 2004-2005 program in regard to learner-learner interaction, learner-instructor interaction, course structure, institutional support, and flexibility. Participants were generally satisfied with the program except learner-learner interaction seen in Table 1.

**Table 1.** participants' satisfaction in the ITCP

| | Mean | Standard Dev. |
|---|---|---|
| Learner-learner interaction | **2.9** | **1.1** |
| Learner-instructor interaction | **3.6** | **0.9** |
| Course structure | **3.9** | **0.9** |
| Institutional support | **3.4** | **1.0** |
| Flexibility | **3.3** | **0.9** |
| **Overall Satisfaction** | **3.4** | **0.9** |

Another study [8] conducted with 54 graduates to examine the impact of program completion on the graduates; the major impact was an increase in the graduates' personal confidence, job autonomy, respect from coworkers, and leadership capabilities. In graduates' personal plans, they wanted to continue to improve themselves in information technology field and monitor technology developments. Especially, graduates working in the IT field were more likely to continue to improve themselves and consider similar programs at another institution or university.

Graduates expressed that there was no problem related to the validity and credibility of the online certificate program; on the contrary, they were appreciated by especially people who are in the IT field due to being graduated from this program. Inan, Yukselturk, and Grant [9] analyzed the dropout ratio in the

program. They found that the percentages of participants who dropped the program were 35.6 % in the previous years. A number of factors were found to support online learners' success in the program. Participants, who had self-regulated learning skills, were highly motivated, had prior experience about the program courses and interacted with fellows and instructors were generally successful.

## 5. CONCLUSION

To conclude, the IDE_A-ITCP program is a successful example of online certificate programs offered by universities. Several surveys have shown the participants' overall satisfaction of the program and its success to enable and help the participants' achieve personal or career goals. It is difficult to say that all universities should be offering these types of certificate programs. However, students, especially adults, can be educated by such programs to meet the immediate demands for qualified persons in certain fields.

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## 7. APPENDIX

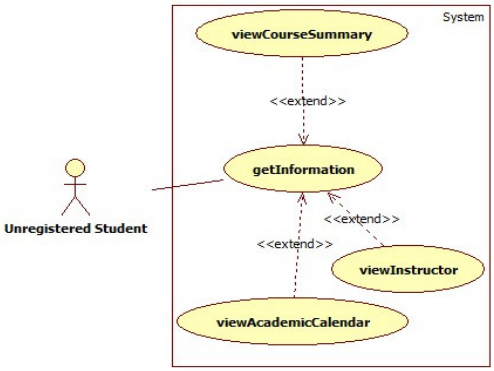


**Figure 2:** Use case of unregistered student component

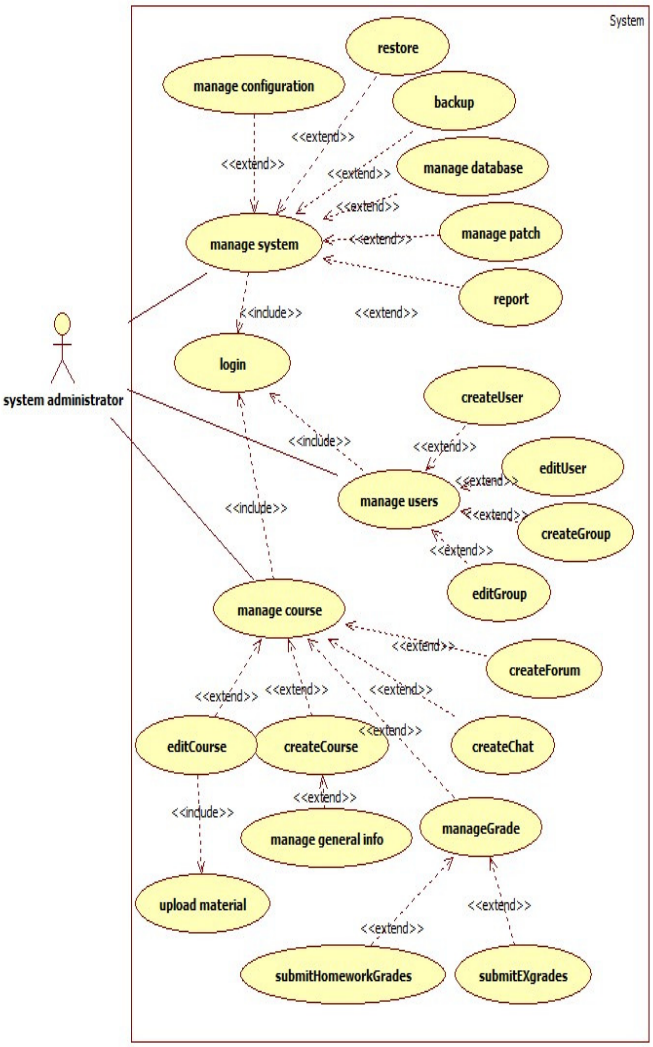


**Figure 3:** Use case of system administrator component

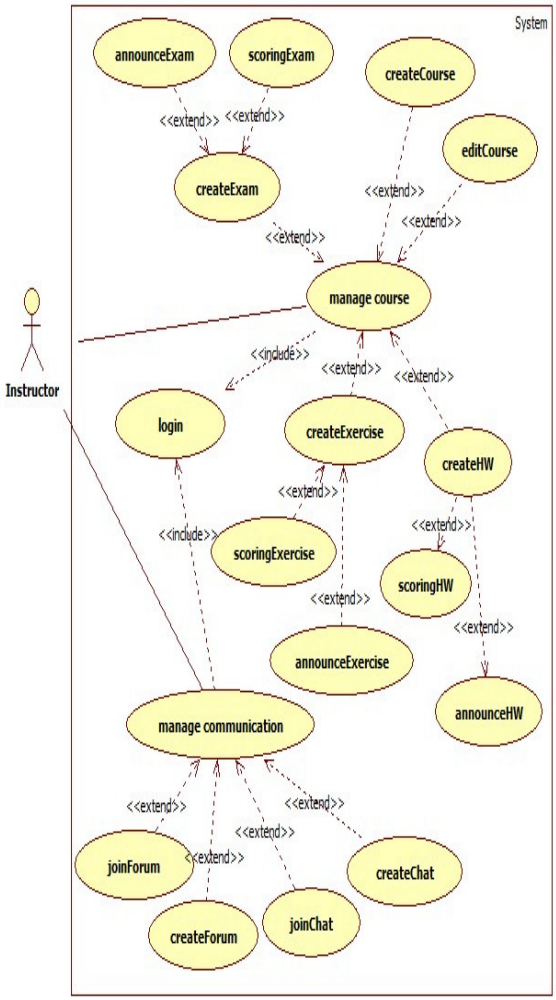


**Figure 4:** Use case of instructor component

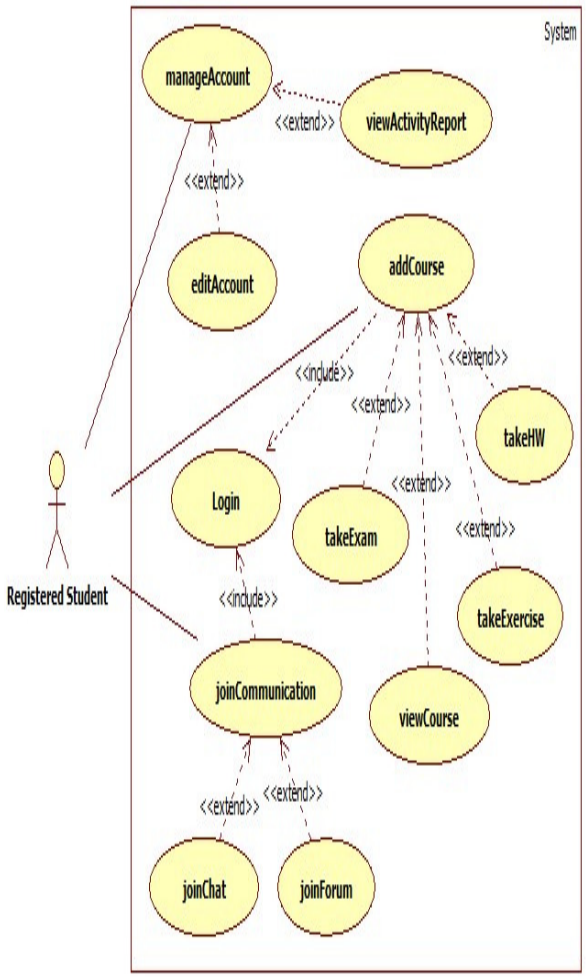


**Figure 5:** Use case of registered student component