

Challenges Of Teaching Computer Science In Transition Countries: Albanian University Case

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ABSTRACT

The main objective of our study is to determine the challenges faced during the process of teaching Computer Science in a university of a country in transition and make suggestions to improve this teaching process by perfecting the necessary conditions. Our survey builds on the thesis that we live in an information age; information technology is an irresistible factor in our era and should be involved in the curriculum of all levels of education. A brief summary of related literature review and some empirical results are provided. Data collected from a survey of freshmen students has been analyzed using simple regression technique. Among all traditional factors that determine performance on computer applications, the authors find that gender, prior knowledge, peer pressure, market conditions, and the quality of delivering the course are statistically important.

Keywords: computer science, regression analysis, teaching in college, transition country.

INTRODUCTION

Generally speaking, a “country in transition” is a nation-state whose economy is in the process of changing from one of central planning to a free market. Simultaneous attempts are also made to change the country’s basic constitutional elements towards a market-based economy. These transition countries have been the focus of research in the areas of both economics and education. There is also research related to technology development in transition countries, considering one of the more pressing concerns relating to technology and information use is the ability of these countries to provide and make useful the necessary skills for proficient computer use. In this paper, the challenges of teaching Computer Science is investigated in order to identify the main hurdles that universities may face during this process.

Before Albania began its transition process, there were no “Computer Application” courses offered in institutions of higher education. However, following the collapse of the socialist regime and the beginning of the democratization process in the education system, some Albanian universities began to offer courses related to Computer Science. The University of Aleksander Moisiu, Durres, (UAMD) for example, is the newest public university in Albania, and actually requires certain “Computer Application” courses.

Opened in 2006, UAMD consists of 1,000 students, 50 lecturers, and 10 administrative staff. From its inception, the university began its educational process with a philosophy that differed from other public universities around. This new philosophy is inspired by the American and European universities` in regard to making policies, formulation of curricula, courses offered, staff hiring, teaching, and evaluation methods. One of the challenges first faced by the university was deciding upon “General Education” courses, with the “Computer Application” course being one of them. The desired purpose of UAMD’s “Computer Application” course is to provide opportunities to both students and staff for gaining and perfecting technological, informational, and computer skills needed to meet the requirements of today’s information era.

The aim of this study is to examine the challenges of teaching Computer Science in Albania, a country in transition. Analyses for this study were conducted at the UAMD using 298 freshmen students, who completed three-part questionnaires used to collect original research data for statistical evaluation. Information gathered by the questionnaire included: (part one) general personal information, (part two) challenges of learning, and (part three) particular situations in the course that take place. Analysis of the gathered data also includes a linear regression model of responses collected from a one-time random survey of freshmen students who had taken “Computer Application I” and are taking “Computer Application II” courses. A number of hypotheses relating to learning as well as the outcomes of the learning process are established, the methodology and data gathering is described, and the results are discussed.

Based upon the results of our research, conclusions can be drawn that suggest gender, prior knowledge, peer pressure, market conditions, quality of teaching, and future expectations are all important factors – some more than others – that play a significant role in determining individual performance in Computer Science courses. Incidentally, few of these factors are determined by the market conditions of the country.

LITERATURE REVIEW

Technology is thought to require a breadth of understanding, a social concern, and a depth of knowledge and skill, all combined with capability (Wilson and Harris, 2004), and technology education is not just a know-how, but necessarily a subject that must be understood and presented in the curriculum of learners as a know-why subject (Seeman, 2003). During the last 60 years, researchers in the academic field of technology and computing have brought together a variety of scientific disciplines and methodologies. The resulting interdisciplinary science, Computer Science, offers a variety of ways of modeling and explaining phenomena, such as computational models and algorithms. The growth of research efforts in computer science has been paralleled by the growth of the number of computing-related fields (Tedre, 2004).

Technology has also been the root cause of economic change; the Internet has already produced great change in society (Levinson, 1998). The technological revolution has affected every country. Unfortunately, most countries in transition have yet to reap the benefits offered by this revolution.

Transition countries differ from the rest of the world by having abnormally high levels of education for their per capita GDP. Such countries typically make attempts to remove legal restrictions on the private sector and create conditions that promote political stability, security justice, and social equity (Spagati, 2002, Milanovic, 1998 & UNDG/ECHA, 2005). Understandably, education obtained prior to the country’s transition process may not be particularly conducive to a market economy.

In the process of transition, the quality of education within the country improves relatively slowly (Medvedev, 2005). Due to the rapidly advancing nature of information technology, however, many topics considered as important little more than one decade ago have become irrelevant as a result of advancements in computer hardware and software. Additionally, regular changes in terminology create new jargon words and phrases that are used and, after time, disappear. These changes drive student expectations regarding what should be taught, reflecting the latest trends in the information technology industry (Dawson and Newman, 2002).

Despite growing use of information and telecommunications technology in transition countries, it seems that the situation has not significantly improved. These countries continue to suffer from very low utilization of two integral resources: information and knowledge. One of the primary reasons for this can be attributed to widespread information illiteracy within the transitioning society. An absence of technological knowledge, skill, and efficient use of information results in a waste of resources, which hampers productivity in all spheres of life and work – education, research, business, and administration. Less developed countries are effectively handicapped in their development because they are unable to capitalize on multiple impact effects from efficient use of information and knowledge resources. Therefore, urgent and energetic addressing of the information literacy issue in less developed countries is necessary, so that further widening of the gap between developed and less developed countries is avoided (Pejova, 2002).

Citizens of these countries must become technologically literate to maintain economic growth. All students need to acquire the skills necessary to become consumers capable of critically assessing the technologies they use, resulting in the ability to make more informed decisions (Weber and Custer, 2005). Computer use is essential in today's world, which has led most universities to offer a basic computer literacy course to all students.

Computer literacy is defined as an understanding of computer characteristics, capabilities, and applications as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society. Computer literacy also includes having a basic understanding of file management processes – such as formatting a disk and how to open, copy, print, save, and delete documents – and using computer application software to perform personal or job related tasks, as well as using web browsers and search engines online, and being able to e-mail (Gupta, 2006, Martin & Dunsworth, 2007).

Indeed, computer literacy is a fundamental part of the undergraduate curriculum in this decade. It is as to undergraduate students as the course work in the core curriculum (Martin & Dunsworth, 2007). Based on these statements and believing in the importance of information technology literacy, at UAMD, the “Computer Application” course is a general education contemporary course.

As a university discipline, Computer Science is relatively young and has yet to firmly settle into the academic fabric of most institutions. Even if a consensus on how to define “computing” is reached, the subject still encompasses a wide range of curriculum, varying from theoretical to practical, hardware to software, and scientific to commercial in application (Carter and Roger, 2002). According to Gibbs and Tucker (1986), early academic programs in Computer Science were of two types: 1) non-credit courses offered by universities for students in scientific disciplines, and 2) graduate programs in Computer Science for students who had significant research interests in context standards. As the field matured, though, and as the model curricula and textbooks developed, the programs at different universities increasingly came to resemble one another (Aspray, 2000).

In pressured economic climates, students often exhibit advanced strategic approaches that lead them to focus primarily on grades and rapid course completion, which can render these students a serious teaching challenge. Another difficulty is the accessibility of programs to a wide range of students, meaning that audiences are as heterogeneous as the curriculum, often with unusual numbers of mature and other non-traditional entrants. This causes a gender bias to the unwary teacher (Carter & Jenkins, 1999). The other challenge is the disproportionate number of staff members of Computer Science departments, who, unusually, have moved discipline because of the impossibility of qualifying in the discipline before it existed (Carter & Roger, 2002).

According to the UK Quality Assurance Agency Guidelines (2006), used to assess university computing courses, there are three skill sections: computing related cognitive abilities, computing related practical abilities, and transferable skills. Yet education does not remain the only prerogative of the government, as private educational institutions appear at a relatively fast pace in most of these countries (Spagati, 2002).

Making comparisons between developing countries and countries in transition based on generalizations is difficult. There are many significant differences in geo-political, economic, social, and cultural backgrounds, as is the level of information literacy among each country's citizens. However, going through similar political, economic, and social changes over the last two decades, most of these countries, regardless their current development level, have certain common points of relevance regarding information literacy issues (Pejova, 2002): new political structures, new functions for state administration, opening of the mass media, and in the case of countries in transition like Albania the process of integration into the structures of the European Union; economic reforms, industrial and organizational restructuring, privatization, mass establishment of new private firms, liberalization and internationalization of the economy, and free market principles which call for more entrepreneurial behavior; extensive creation of new legislation as a result of dramatic political and economic changes compounded by a need for adoption of and compliance with international standards; development of telecommunications infrastructure, introduction of the latest information and telecommunication technologies, development of an information services industry, and adaptation of education and training systems to international standards to make these countries targets for potential markets of education and information service industries of developed countries.

When comparing developed and less developed countries in regard to the situation of promotion and implementation of information literacy, developed countries exhibit the following (Rado, 2001, Porter & Miller, 1985): strong, massive movements and networks of organizations and professional associations engaged on the information literacy promotion and implementation; well-developed library and information systems and networks; a significant turning of the schools' and universities' attention to the lifelong skills of learning how to learn, which is essentially educating students to find, evaluate, and effectively use information; well-educated and trained information and library professionals and enthusiastic educators acting energetically and, in many cases, on self-initiative; plethora of information literacy curricula and syllabi, many of them available on Internet accompanied by innovative approaches on how to teach information literacy (objectives, standards, measures); and users who, through a culmination of schooling, have been exposed to and taught to use rich and well-organized information resources.

As opposed to: lack of co-operation among professional organizations and lack of well articulated and/or promoted information literacy policies and programs; underdeveloped library and information systems and networks; expensive telecommunication infrastructure services; shortage of information and library educated and trained professionals who would give the necessary impetus to information literacy promotion and implementation; intimidated users who are not so well acquainted with the nature of information and its creation, how information is published and disseminated (the pattern of flow of information within a discipline), that is without the mental map of the information and publication world.

Countries in transition can only reach the same level as developed countries by involving the teaching of technology and information in the curriculum of their educational institutions. The curriculum may be involved in Computer Science or simple "Computer Application" courses offered. Yet still, there does not exist any clear agreement even on the name of the field: in European universities it is called "Informatics," in the U.S., "Computer science," and in other regions of the globe, "Information Systems" or "Computer Studies."

With the progress of this scientific field, there has been a subject change in subject areas. According to Zadeh (1968), the dominant subjects are those such as e-commerce, workflow, virtual reality, robots, software engineering, management information systems, and human-computer interaction. The expansive development gap between developed and developing countries and countries in transition (in other words, less developed countries) has been particularly striking in the asymmetry in access to and use of vast repositories of information and knowledge in the world (Pejova, 2002).

Today, there are signs that Computer Science is turning to application areas. As the science contributes its models, tools, and techniques to these new fields, they in turn will contribute new ideas and methodologies that will further enrich the scope of Computer Science. Undoubtedly, computers have already had a major impact on society and the way that people think and live; Computer Science can be regarded as a means to take people to a higher plane of knowledge of the world (Hopcroft, 1987).

In consideration of the literature and facts mentioned, countries in transition should strive to establish techniques in their development strategies to provide necessary skills that allow citizens to best utilize technology and information.

STYLIZED DATA

In Albania, courses in the area of Computer Science have recently become offered in high schools and universities. The knowledge offered in these universities, generally speaking, is theory based and has a lack of practice as a consequence of missing of computer labs.

At the UAMD, the "Computer Application" course is an obligatory general education course and is offered in two academic semesters. During each semester, students take 45 hours (3 ECTS credits). Classes consist of 40 students, each of whom is assigned a personal computer. The knowledge gained from the course is controlled by three exams (two midterms and one final) and to pass, the student must earn at least 60% of the maximum points. In the first semester of "Computer Application I" at UAMD, the passing rate was 61.23.

The survey in this study is based upon responses provided by students who had taken “Computer Application I” and, at the time of the survey, were taking “Computer Application II” courses. In general, the students surveyed were 17-18 years old (the typical age of first-year students at a university in Albania) and had previously taken Computer Science courses in high school. Among 650 students enrolled in the “Computer Application I” course, 480 questionnaires were handed out and later collected by one of the students in the class. Of the questionnaires received, 298 have been statistically evaluated.

HYPOTHESES

We will assume that the challenges of teaching computer application courses are determined by several factors. The factors analyzed in this study are: gender, prior knowledge about computer applications, peer pressure (exhibited in the form of having heard from others about the importance of computer skills for future employment), the market conditions (students’ perceptions regarding the role of computer skills and knowledge in successful entry into tomorrow’s job market), teaching methods and styles (theory serves the practice and application of knowledge gained in the prospective workplace), and expectations about what the future will hold for students gaining skills in computer applications. Further, we assume – as will be explained in this paper – that the performance in this course is directly related to these factors.

A number of hypotheses will be tested for determining and understanding the challenges of teaching “Computer Applications.”

- H1** Males and females learn basic and advanced computer concepts and programs at different rates. Female students learn basic computer use faster than males. Since the 1980s, a curriculum known as Technology Education has evolved from the earlier industrial arts. Industrial arts has failed to attract many female students, but there are also some social indicators that make technology curriculum more attractive to females (Haynie, 2003). However, when it comes to learning advanced programs and how certain parts of a computer function, males learn faster. Programming jobs and jobs related to the construction of computer parts have always been seen as jobs for men. Due to the historically disproportionate involvement of males in industrial arts and technology education, males’ perspectives and interests tend to pervade technology education curriculum (Weber and Custer, 2005).
- H2** The learning of basic and advanced computer concepts and programs directly varies with peer pressure. Social pressure is a factor that stimulates students to strive harder (Moti, 2005). If a student continually hears from others that computer knowledge is important, out of the natural desire to be a part of society, he or she will be more interested in taking the computer courses than they would have been otherwise.
- H3** The learning of basic and advanced computer programs varies directly with prior knowledge. A student’s performance who has taken computer courses in the past are markedly better than the performances of those who are taking a computer course for the first time.
- H4** The learning of basic and advanced computer programs varies directly with market needs. If the market demands workers with computer skills, students who aim to be a part of this market tend to perform better than others less motivated.
- H5** The learning of basic and advanced computer programs varies directly with teaching conditions. The more conducive to learning the conditions are, the better students learn. Among conditions we can mention: lecturer performance and field relations, teaching and evaluation methods, materials used, and infrastructure.
- H6** The learning of basic and advanced computer programs varies directly with expectations of students. If students have clear expectations related to the “Computer Application” course, they will be more interested and eager to learn.

THE MODEL AND DATA

Among all factors in the challenges of teaching Computer Science courses, the most novel identified by our study – making it genuinely unique – are prior computer knowledge, peer pressure, and expectations. These three factors are related in a special way due to the history of computer use in Albania and other transition economies. Generally, these countries have experienced a limited use of information technology and, even more so, computers. These limitations have had a direct effect on the knowledge and perception of those who can exert pressure (in a positive way) on prospective students to attend and make concerted efforts to master Computer Science courses.

Another important factor affecting performance of students who take computer application courses is the teaching style used in the course; specifically, how theory is taught in conjunction with practice. The Eastern schools commonly used to offer an introductory course in Informatics that relied heavily upon theory and very little (if any at all) practical application of theory. This had the potential to influence friends of students when discussing school courses and the effort made by the student taking the computer application course, indicating to the friend that computer knowledge should not be a top priority. On the other hand, new businesses and media have made efforts to advertise the use of information technology, underlining the importance of computer knowledge. These two contrasting lines of thinking have to be checked with data analysis later in this paper.

The OLS model is used, based on the data collected from surveying 298 UAMD students who had taken the “Computer Application” course. The equation of relationship between student performance in this course and all other factors is as follows:

$$Y_t = b_0 + b_1X_{1t} + b_2X_{2t} + b_3X_{3t} + b_4X_{4t} + b_5X_{5t} + u_t \tag{1}$$

where: $t = 1-298$, measures observations; Y measures the performance level of a freshmen student in computer application class; X_1 measures level of prior knowledge; X_2 measures the peer pressure index; X_3 measures market conditions, X_4 measures the index of teaching computer applications, and X_5 measures expectations about the future need for computer application knowledge that students gain while in college. This equation is based on two assumptions: 1) variation in Y is caused by X_s , and 2) the relationship between Y and X_s is linear. These variables and their descriptive statistics are given below (Table 1).

Table No. 1: Descriptive Statistics

	<i>Y</i>	<i>D</i>	<i>X1</i>	<i>X2</i>	<i>X3</i>	<i>X4</i>	<i>X5</i>
Mean	2.946	0.490	2.091	1.980	3.634	3.842	4.128
Standard Deviation	0.923	0.501	1.029	1.107	1.182	1.166	1.007
Sample Variance	0.852	0.251	1.059	1.225	1.398	1.359	1.014
Kurtosis	0.035	-2.012	-1.050	-1.029	-0.531	-0.222	1.083
Skewness	-0.668	0.040	-0.388	0.595	-0.576	-0.832	-1.214
Minimum	0.000	0.000	0.000	1.000	1.000	1.000	1.000
Maximum	4.000	1.000	4.000	5.000	5.000	5.000	5.000
Count	298.000	298.000	298.000	298.000	298.000	298.000	298.000

The equation based on these two assumptions attempts to quantify the relationship between Y and X_s , as well as to evaluate the effect these independent variables have on the performance level of students. All data on dependent and independent variables is taken from a random survey of UAMD students conducted in March 2007, after students had received their grades for the “Computer Application” course taken the previous fall. Students participating in the survey were chosen from a 1,000 pull of students. The questionnaire used for the purpose of this survey was handed out to 400 students, 298 of whom completed and returned the questionnaire. The students of

UAMD are all Albanian and are considered students of a country in transition. Participation in the survey was entirely voluntary. The questionnaire prepared by the authors of this study was first tested on 70 students for validity purposes, and was subsequently used to collect all data on the variables discussed. All data are indexes of student perceptions regarding questions asked on the questionnaire.

DISCUSSION OF THE RESULTS

We assume that the relationship between dependent variable Y (performance level on “Computer Application” course) and independent variables (X₁, X₂, X₃, X₄, and X₅) is linear, and are interested in estimating coefficients “b” of equation (1) in order to gain better understanding of the postulated relationship. This functional linear relationship is estimated using OLS regression technique (Table 2). The following estimates have been obtained:

$$Y_t = 2.54 + 0.15X_{1t} + 0.08X_{2t} + 0.05X_{3t} + 0.07X_{4t} - 0.12X_{5t} + u_t \tag{2}$$

This is the estimated equation for the entire sample.

Table 2: Regression without Dummy

<i>Regression Statistics</i>				
Multiple R	0.257990958			
Standard Error	0.899566195			
Observations	298			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.536719856	0.31173251	8.13748895	1.1733E-14
X1	0.149981196	0.051986772	2.88498769	0.00420585
X2	0.077389681	0.048155537	1.60707752	0.10911812
X3	0.051757803	0.045943733	1.12654761	0.26085876
X4	0.066267078	0.04728139	1.40154673	0.16211264
X5	-0.121113999	0.053006141	-2.284905	0.02303548

Looking at the regression output, we identify that Multiple R is equal to 0.26. The effect of each independent variable (X) on Y is given by respective coefficients. Looking at t-Stat coefficients of X3 is not statistically significant; others, yes.

In order to decompose the effect of gender, when considering the impact of each of the studied factors on the variation of student performance, a new “dummy” variable is introduced. As a result, the following equations have been estimated:

$$Y_t = b_0 + b_1X_{1t}D + b_2X_{2t}D + b_3X_{3t}D + b_4X_{4t}D + b_5X_{5t}D + u_t \tag{3}$$

$$Y_t = 2.68 + 0.19X_{1t} + 0.11X_{2t} + 0.1X_{3t} + 0.06X_{4t} - 0.17X_{5t} + u_t \quad \text{if female student} \tag{4}$$

Table No. 3: Regression with Dummy

<i>Regression Statistics</i>				
Multiple R	0.365970325			
Standard Error	0.866493268			
Observations	298			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.684975557	0.069319691	38.73323038	4.5336E-117
D*X1	0.18716852	0.070459291	2.656406537	0.008332056
D*X2	0.113551876	0.060024709	1.891752208	0.059513357
D*X3	0.097577276	0.055592065	1.755237494	0.080267317
D*X4	0.06380715	0.056815254	1.123063715	0.262332958
D*X5	-0.168863637	0.059547242	-2.83579273	0.004890651

CONCLUSIONS

Students` performance in “Computer Application I” is determined by their gender, female students learn basic computer use faster than males. It is also determined by prior knowledge as a student`s performance who has taken computer courses in the past are markedly better than the performances of those who are taking a computer course for the first time. Peer pressure is also a factor that determines the students` performance in “Computer Application I”, because a student who has continually heard from others that computer knowledge is important, is more interested in taking the computer courses than the others; by teaching conditions and by the students future expectations. Among the factors that do not determine this performance, market conditions and needs of the country can be mentioned. So, the market`s demanding of workers who have computer skills do not affect the performance of the students` computer skills that tend to be part of this job market.

AUTHOR INFORMATION

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