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COMPARISON OF TURKEY AND EU REGARDING ICT ASPECTS FOR PUPILS

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ABSTRACT

This study had two main purposes. First was to investigate the similarities and differences in perceived ICT aspects of 15 year-old students participated in the Programme for International Student Assessment-2003 study across EU member group, new EU member group and Turkey (country groups). Second was to examine the perceptual evaluations of policy makers on these similarities and differences in ICT aspects. Responses of 56,610 students from EU member group, 24,834 students from new EU member group and 3,231 students from Turkey were analyzed. One-way MANCOVA –controlling students' economic, social and cultural status (ESCS) and attitudes toward computers– and one-way ANCOVA –controlling students' ESCS– analyses were conducted to understand whether perceived ICT aspects differ across country groups. Statistical analyses yielded significant results. Results indicate that Turkish students have lower self-confidence in using computer and Internet and they use Internet less frequently than students in EU. Contrary to this, Turkish students have relatively more positive attitudes toward computers and they use program/software more frequently than do students in EU although these results are not practically significant. Participants of this study frequently related these results to cultural characteristics, ICT school curriculum, low access rate to computers and Internet, and low ESCS of students.

Keywords: *ICT use, Self-Confidence In Ict, Attitudes Toward Computers, Ict-In-Education Policy, PISA 2003*

INTRODUCTION

The countries have entered into the new millennium with such interdependent challenges as insufficient economic conditions, increasing population, huge information explosion; that they lead respectively to low standard of living, inadequate quality in education, and the need to access, process and share information. On the contrary to these challenges, there have been some rapid developments in scientific, industrial, technological and educational areas especially for last three decades. After the products from these developments, particularly technological ones as microcomputers, have become affordable for end users in the early 1980s, the concept of computers in education was included in the agenda of education policy makers. This situation was primarily supported by the governments with the fear of loosing technology race. Then, at the end of the 1980s, the focus shifted from computing technology to storing and retrieving information, thereby the concept of information technology (IT) superseded the concept of computers in education. Later on, in conjunction with spreading of

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email for general public, IT was replaced by a new concept of information and communication technologies (ICT) in the early 1990s (Pelgrum & Law, 2003).

The international ICT literacy panel convened by Educational Testing Service (ETS) has defined ICT literacy as "using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society" (Kirsch et al., 2007, p.2). Considering growing importance, and ubiquity of ICT literacy in almost all aspects of the life, the governments investing their human capital aim their citizens to be ICT literate in order to transform their society into knowledge society. This was almost the precondition of and catalyst for such transformation in the early 2000s. Having ICT literacy requires citizens to gain ICT competency, which knowing how to collect, apply, interpret and represent, evaluate, and generate information as stated in the definition of ICT literacy.

Lisbon strategy signed by the EU in 2000, vision of Europe for 2010 was to modernize their economy and adapt their education systems to meet the needs of the knowledge society. With this strategy, the EU set an ambitious and strategic goal for the next decade as "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion" (Council, 2006, para. 8). In order to realize such a strategic goal, the members have started full commitment, and broader and deeper engagement process that involves set of policies, initiatives, actions, and structural reforms in the areas of employment, innovation, economy, social cohesion and environment through direct actions promoting ICT use, and education and vocational training (Council, 2006). Therefore, governments in the EU aim to provide their young adults with ICT competency in compulsory education before they are launched into real life. As a consequence, comparison of relative ICT literacy position of Turkish students with EU partners in compulsory education becomes very important for especially developing countries like Turkey, as a candidate state for the EU. In this sense, such a comparison could help education policy makers chart a possible way forward in ICT-in-education policy, ICT related initiatives, projects and programmes to launch and spread ICT use in educational institutions.

Developments in ICT-in-education policies, initiatives and projects in Turkey

ICT investments started in secondary schools in 1984. These investments continued, especially in upper secondary schools, in the years 1984–1991. Attempts to develop instructional software for Computer-aided instruction (CAI) in collaboration with the Ministry of National Education (MONE), the private sector and universities were seen in 1988–1991. In the late 1980s and early 1990s, a few in-service training activities were also held on basic computer skills for teachers, with the support of universities. In the 1990s, within the framework of the National Education Development project, 53 Computer Experimental Schools and 182 Computer Laboratory Schools projects were started in selected secondary and basic education schools (in 1993 and 1996, respectively). The main aim of these two projects was to investigate ways to integrate computers into the Turkish education system (MONE, 1999, 2003).

Project 2000 for Keeping Pace with the Age in Education was launched as a short-term project after the Education Master Plan 1996–2011 had formed on the basis of policy recommendations from the Seventh 5th Year Development Plan and the 15th National Education Council. Afterwards, in 1997, compulsory education was expanded from five to eight years. The long-term plan, as a strategy of the master plan, Basic Education Project (BEP) was initiated in 1998 (Eurydice, 2007). The main purpose of this project was to generalize basic education throughout Turkey, to enhance the quality of basic education and to convert schools into community learning centers. One of BEP objectives was directly related to

ICT: generalizing the use of computer technologies in education through establishing IT rooms in every basic education school. The first phase of this project was implemented in 1998–2003, and the second phase in 2002–2007 (Eurydice, 2007). Since the government in Turkey and project leaders in the World Bank changed, the second phase of BEP (BEP II) actually started in 2005. Besides the main aims and objectives of BEP, generalizing pre-primary school education and improving special education throughout Turkey were among the objectives of BEP II (MONE, 2005).

It could be concluded that hardware investments were more dominant in the ICT integration process up to 2003. These investments for basic education schools were actually made in 1998–2000 within BEP I (3,188 IT rooms in 2,802 primary schools). However, the Internet connections at schools were limited and slow (Akbaba-Altun, 2006; TBŞ, 2002) until December 2003.

Integration of ICT into K-12 Schools in Turkey and the EU

Since the early 1980s, developed countries have invested in technology for educational settings. According to the Eurydice report on integration of ICT into education, ICT investments have been seen in K-12 schools in almost all EU countries throughout nationwide ICT projects beginning around the mid-1990s. Every European country has a policy document in the form of law, decree, curricular recommendation, and action plan for the use of ICT in primary and/or secondary education. Parallel to these developments, it is seen that number of students per computer is between 5 and 20 in most European countries based on PISA 2000 data of 15-year-old students (Eurydice, 2004). Even in five of new EU member group joined in 2004, this ratio is 22.9 on average. In 2001, this number was 37 students per computer in upper secondary schools in Turkey (TBŞ, 2002). Computerization of schools that 15-year-old students attend in new EU member group is almost two times, in EU member group is considerably larger than that of schools in Turkey. It is clear that EU makes more ICT related investments in K-12 schools than Turkey.

As to in-service training, percentages of primary and secondary school teachers who had received official training in the use of computers and/or the internet in their teaching is 62% and 50% respectively in EU member group in 2001 (Eurydice, 2001). On the other hand, teachers having participated in-service training are not satisfied with the quality of in-service training activities for teaching with technology due to not structured in localized, not addressing real needs and not ongoing and on time in Turkey (Yıldırım, 2007).

In line with ICT investments and in-service training on ICT as a tool in other subjects, in EU, 71% of teachers use computer and 34% of them use Internet in the classroom in primary schools. Primary school teachers use computers 5 hours in a week on average. As to secondary school teachers, 60% of them use computer and 42% of them use the Internet in the classroom in 2001 (Eurydice, 2001). On the contrary, in Turkey it is not common to put computers into classrooms yet, rather, computers are in a room, called as IT room and these rooms are mostly used for elective ICT courses as a separate subject. Furthermore, according to the ICT impact study results conducted by Ministry of National Education (MONE) in 2004, all teachers perceived that IT rooms are installed only for ICT courses, and they are not aware of the fact that they have a right to use IT rooms in their teaching (MONE, 2005). In fact, the role of pedagogy and teachers' beliefs about teaching and learning are central to ICT integration (Mumtaz, 2000).

ICT is generally used as a tool in primary school curriculum in EU member group (Eurydice, 2001). This trend also exists in secondary schools with support of separate ICT courses

(Eurydice, 2004). According to the survey conducted in 2002–2003 school year by Eurydice, K-12 schools' compulsory curriculum in most of EU countries involves ICT related objectives under an additional category, namely, to "use ICT to enhance subject knowledge" for teaching or use of ICT (Eurydice, 2004, p. 23). By releasing this new objective, students' meaningful use of ICT for a specific purpose could be expected more in EU countries. On the contrary, teaching ICT as a separate subject is the most common approach in K-12 curriculum in Turkey. Indeed, using ICT as a tool for a meaningful purpose has not been appeared in written curriculum until curriculum reform initiated in 2004. Thus, Turkey could be seen at the initial stage of using ICT as a tool in teaching and learning of other subjects.

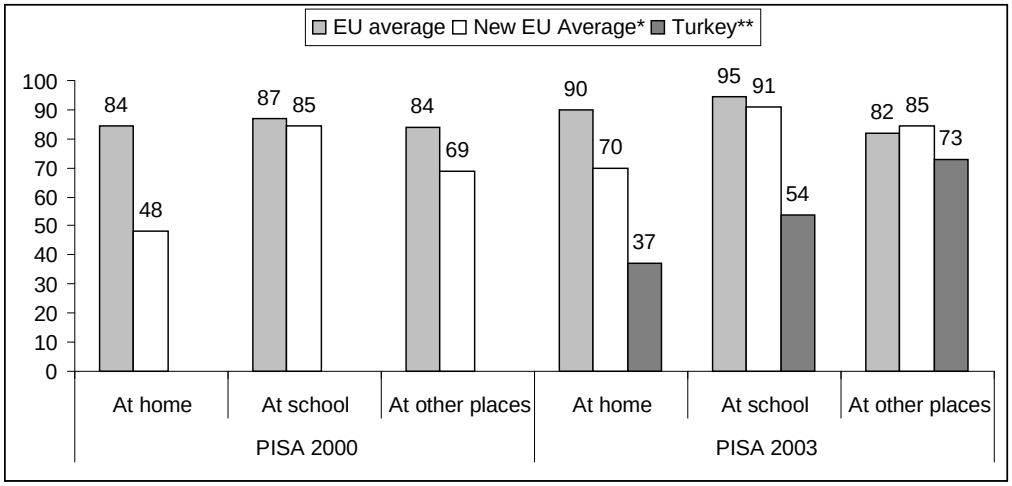
In summary, the infrastructure and teachers' use of ICT in subject courses are not as common as in European countries, although Turkey has been conducting ambitious projects and investing considerable money in ICT provision to schools for educational purposes since the mid-1980s.

Overall computer access (at home, school and other places)

As seen in Figure 1, in 2003, access to computer at school is most common type of access in both EU groups and their proportions are also close to each other. However, access at home becomes second common way in EU member group, while access at other places is second common way in new EU member group. Although there was a gap between the rates of computer access at home between both EU groups in 2000, 48% for new EU member group and 84% for EU member, this gap is in a closing trend in 2003. With a significant jump, 70% of students have computer access at home, whereas EU member group show around 5% improvement in access to computers at home. On the contrary, for Turkish students, the most common access is not at school, but at other places (73%). The second common place of access is school in Turkey, but 54% students have this access while it is more than 90% in both EU groups. Similarly, the rate of access to computer at home is relatively too low in Turkey, 37% in 2003. This rate is almost two times larger in new EU member group and two and half times larger in EU member group. Nevertheless, notice that rate of computer access at other places is relatively similar in those three country groups; even if this rate is lower than both EU groups in Turkey. Under these conditions, Turkish students are in disadvantaged position in terms of access to computers particularly at home and at school.

Programme for International Student Assessment (PISA)

In 1997, the Organisation for Economic Co-operation and Development (OECD) launched three-year cycled programme going under the name of PISA in order to respond to demands of regular, reliable and valid data on knowledge and skills of students, educational demographics and performance of its members' and partner countries' education systems. After three year preparation for the first cycle, the first study took placed in 2000, second and third studies conducted by the same token in 2003 and 2006. Besides performance tests, the PISA collects contextual data on students' socioeconomic and cultural background, and ICT familiarity (PISA, n.d.).



Note: *New EU member group include data from Czech Republic, Hungary, and Latvia in PISA 2000. ** Turkey did not participate to PISA 2000, thus no available data for Turkey in 2000. Source: OECD, 2006

Figure 1. Students' computer access rate for country groups on average in PISA 2000 and 2003

Purpose and Research Questions

The main purpose of this study has two folded: first was to investigate the similarities and differences in perceived ICT aspects of 15 year-old-students in the PISA 2003 study across the country groups (EU member group, new EU member group and Turkey) and second was to examine the perceptual evaluations of policy makers about the detected similarities and differences in ICT aspects across Turkey and both EU groups. More specifically, the following research questions have been investigated in this study:

(1) How does type of ICT use –Internet/Entertainment Use and Program/Software Use– differ among the students in PISA 2003 across the country groups when the effects of attitudes toward computers (ATTCOMP) and economic, social and cultural status of students (ESCS) are controlled?
(2) How does the self-confidence in ICT related tasks –Routine, Internet and High-Level– differ among the students in PISA 2003 across the country groups when the effects of ATTCOMP and ESCS are controlled?
(3) How does ATTCOMP differ among the students in PISA 2003 across the country groups when the effect of ESCS is controlled?
(4) How do Turkish education policy makers evaluate the similarities and differences in perceived ICT aspects of the students in PISA 2003 from the country groups?

METHODOLOGY

Quantitative phase of the study

Population, Sampling and Sample

Experts from the PISA Consortium determine the population and sampling and closely monitor the countries for their national sampling. A two-stage stratified sample design is generally used for almost all of the countries in PISA 2003 study. At first stage, schools are selected, where 15-year-old students enrolled at educational institutions; afterwards students are randomly

stratified sampled within each selected school (OECD, 2005a). Based on this sampling procedure, at least 150 schools and 4500 students are selected for each country (OECD, 2005b).

As to this study, before statistical analyses are conducted, the countries participated PISA 2003 from the EU who administered ICT familiarization questionnaire and Turkey are filtered. Thus, the countries, having no data on ICT, are excluded from all statistical analyses even they participated PISA 2003 study. Then, these countries are categorized into three country groups. The categorizing criterion in construction of these groups is based on the status of country in the EU: 1) The EU member group (founder of the EU or joined the EU before 2004), 2) the new EU member group (joined the EU in 2004), and Turkey (as candidate state for the EU). Consequently, EU member group has 11 members, new EU member group has 5 members and Turkey has herself, as seen in Table 1.

Table 1. Country Groups with Members

Country Groups	**Members**			
EU member group	Austria Belgium Denmark	Finland Germany Greece	Ireland Italy Portugal	Sweden United Kingdom
New EU member group	Czech Republic Hungary	Latvia Poland	Slovak Republic	
Turkey				

Since the scope of this study is limited to Turkey and the EU groups, the target and accessible population of this research is computed by adding up students in the country groups. This study focuses mainly on comparing type of ICT use, self-confidence in ICT related tasks, and attitudes toward computers; hence the students, who only used computer and have non-missing composite scales related to ICT aspects are taken to constitute all subjects of this study. Consequently, sample size of this study for country groups are given in Table 2.

Table 2. Sample Sizes for Country Groups

EU member group	New EU member group	Turkey
56,610	24,834	3,231

Data Collection Tools

In PISA 2003, four subject domains, mathematical (as a major domain), reading, scientific and problem solving (as minor domains) literacy, are assessed to understand whether the ability of 15-year-old students in using their knowledge and skills will meet real-life problems or challenges or not. Furthermore, PISA collected data on student background and demographic information through administering student questionnaire. In addition to these, an ICT questionnaire has also offered as an optional questionnaire. It takes around five minutes.

Measures

This study is specifically interested in data on ICT aspects and student socioeconomic background (the index of economic, social and cultural status of students: ESCS). ESCS is calculated by PISA from the raw data collected via student questionnaire. Similarly, six ICT index scales calculated by PISA form the raw data collected via ICT questionnaire. The ICT indexes are related to type of ICT use (Internet/entertainment use and Program/software use), self-confidence in ICT tasks (Routine tasks, Internet tasks, and High-level tasks), and attitudes

toward computers. Type of ICT use, self-confidence in ICT tasks, and attitudes toward computers are called as ICT aspects in this paper.

Validity and Reliability

Since PISA 2003 is to aim at international comparisons, what critical is to ensure validity, through considering language and cultural settings of questionnaires' content, and format. In order to provide content-related evidence of validity, PISA consortium experts worked collaboratively with content developers, expert groups, and national experts on such issues as development of assessment frameworks, test development procedures, item submission guidelines, national and international review of items, and translation (OECD, 2004, 2005b). The construct-related validity was also ensured by PISA through field trials in a two-year period (OECD, 2005b). The constructs –ICT related indexes and ESCS index– analyzed in this study are taken from PISA 2003 student database, which were derived from the student and ICT questionnaires. They are used to explore relationships in ICT aspects and economic, social, and cultural status of students across country groups.

Separate reliability analysis is conducted to obtain constructs' internal-consistency estimates of reliability for each participating country in PISA 2003. ICT indexes and ESCS index, constructs of this study, are considered to calculate internal-consistency estimates of reliability for the country groups. The averages of internal-consistency estimates of reliabilities belong to country groups for this study are given in Table 3 (OECD, 2005b).

Table 3. The Calculated Alpha Reliability Coefficients of the ICT Indices and ESCS Index

ICT Indices and ESCS Index	Country Groups		
	EU member group	New EU member group	Turkey
INTUSE	0,81	0,82	0,86
PRGUSE	0,78	0,80	0,85
ROUTCONF	0,88	0,90	0,93
INTCONF	0,79	0,85	0,88
HIGHCONF	0,84	0,85	0,86
ATTCOMP	0,82	0,80	0,80
ESCS	0,67	0,69	0,76

Note: Reliabilities (Cronbach's alpha) computed with weighted national samples. The values in Table 4 are obtained and calculated from PISA 2003 Technical Report, OECD 2005b, pages 307–320.

INTUSE	:Internet/entertainment use	HIGHCONF	:Self-confidence in High-level tasks
PRGUSE	:Program/software use	ATTCOMP	:Attitudes toward Computers
ROUTCONF	:Self-confidence in Routine tasks	ESCS	:Economic, social and cultural status of students
INTCONF	:Self-confidence in Internet tasks		

Statistical Data Analyses

After obtaining original raw data from OECD official website, the following preliminary statistical procedures were conducted to make huge dataset smaller and easily understandable: excluding (unrelated variables), creating (variables, such as country groups), filtering (students used computer), missing value analysis, and etc. Research questions and nature of variables determine the statistical analyses –one-way MANCOVA and a univariate ANCOVA– to be conducted. SPSS 13.0, statistical package program, was used to examine the similarities and differences in ICT aspects of country groups. Since user-missing and system-missing in data file are transformed into system-missing in preliminary statistical procedure, a listwise deletion method was used in one-way MANCOVA and ANCOVA analyses. The general information

on statistical analyses in terms of related research questions and variables and are given in Table 4.

Table 4. Information on Research Questions, Variables, Covariates and Statistical Analyses

IV	DVs	COVs	Statistical Analyses
Status of a country in EU: 1: EU Member Group 2: New EU Member Group	INTUSE PRGUSE ROUTCONF INTCONF HIGHCONF	ATTCOMP ESCS	One-way MANCOVA and follow-ups (ANCOVA & Contrast-K matrix for pairwise comparison) for the 1st and 2nd research questions
3: Turkey	ATTCOMP	ESCS	A univariate ANCOVA for the 3rd research question

Note: IV: Independent Variable, DVs: Dependent Variables, COVs: Covariates

Qualitative Phase of the Study

Participants

Purposive and referential or snowball sampling procedures were used to determine information-rich cases and collect in-depth data. There were seven participants. Four of them from the Ministry of National Education (MONE) and three of them were from two state universities in Ankara.

Data collection method

Semi-structured interview was selected as the most appropriate data collection technique.

Data collection instrument

The semi-structured interview schedule was developed by the researcher. The quantitative results (univariate and multivariate analysis of covariance) were transformed into graphical representations and short verbal explanations so that the results could be understood as the same by every participant with different backgrounds. The researcher asked for consultation from two experts on qualitative research in education during this transformation process. The representations and explanations were then transformed and embedded into the interview schedule. The interview schedule was examined by a Turkish literature teacher in order to increase the comprehensibility of the introduction, questions, representations and their explanations. Two pilot studies were conducted to test the comprehensibility of questions and representations in the interview schedule.

Data collection procedure

Approximately ten days before interviewing, the interview schedule, including the results and their representations about similarities and differences of ICT aspects, was given to the participants, so that they could examine and understand the results. Seven interviews were conducted at appointed times and places. During the interviews, each of which lasted around one and a half hours, note-taking and voice recording were used for policy makers and academicians, respectively.

Validity and reliability

In connection with validity and reliability, the data collection technique of a semi-structured interview with carefully formulated open-ended questions and prompts is the most appropriate one to clarify ambiguous points and collect more comprehensive and meaningful data. Taking

help from two experts in qualitative research and a Turkish literature teacher, and conducting two pilot studies also contributes to increased validity and reliability. Furthermore, neither using any leading probes, cues or corrections during the any of interviews, nor experiencing any distraction, disturbance, and intervention or time restriction also enhance validity and reliability.

Data Analysis

Recorded interviews were transcribed and notes were transformed into digital format in a Word processor program. Transcriptions were read several times and then analyzed with content analysis. More specifically, integrated coding –both using inductive and deductive coding– was conducted to understand and interpret the data. The coding procedure proposed by Strauss and Corbin (1998) was applied in the data analysis. First, relevant phrases and sentences were labeled through open coding, and then patterns and major themes emerged. Next, axial coding was conducted to develop a coding system through relating categories to sub-categories. Finally, selective coding was conducted to identify a central theme for interpreting the whole phenomena.

RESULTS

Comparison of ICT aspects across country groups

For the first and second research question, one–way MANCOVA was conducted to investigate the similarities and differences in students' type of ICT use and in self-confidence in ICT related tasks across the country groups, controlling ATTCOMP and ESCS. From the multivariate ANCOVA tests, Pillai's Trace statistic was preferred and interpreted since Box's M test was significant. Significant differences were found among three country groups on ICT indices, controlling ESCS and ATTCOMP, Pillai's Trace = .058, F (10, 169334) = 508.983, p<.001 (see Table 5). However, the multivariate η^2 based on Pillai's Trace was small, .029 (Cohen, Cohen, West, & Aiken, 2003), meaning that after ESCS and ATTCOMP held constant, status of country group in EU explains 2,9% of variance in the best linear combination of adjusted means of ICT aspects.

Table 5. The Results of One-Way MANCOVA and follow-up ANCOVAs

	DVs	Covs	Pillai's Trace	*Df*	*Error df*	*F*	*p*	η^2
MANCOVA	INTUSE PRGUSE ROUTCONF INTCONF HIGHCONF	ATTCOMP ESCS	.058	10	169334	508.983	<.001	.029
ANCOVA as follow-up for MANCOVA	INTUSE					582.112		**.014**
	PRGUSE					23.952		.001
	ROUTCONF		–	2	84670	897.294	<.001	**.021**
	INTCONF					1493,256		**.034**
	HIGHCONF					351.836		.008

All the ANCOVAs conducted as follow-up tests for MANCOVA were statistically significant as well. However, their partial η^2 values were small. Thus, the results have not much practical significance. The statistical significance could be due to the large sample size. In this sense, the follow-ups were examined in a descriptive manner. The adjusted mean scores and standard errors on the dependent variables are shown in Table 6. Follow-up tests (Contrast-K matrix that

compares adjusted mean scores) indicated that there are significant mean scores differences among country groups for almost all ICT indexes, controlling for ATTCOMP and ESCS (Table 7). ANCOVAs and their related pairwise comparisons were explained under the related research questions below.

Table 6. Adjusted Mean Scores and Standard Errors of ICT Indices

Dependent Variables		Country Groups		
		EU member group	New EU member group	Turkey
INTUSE	*M*	**–0,011**	–0,224	–0,163
	SE	0,003	0,005	0,015
PRGUSE	*M*	0,006	0,039	**0,096**
	SE	0,004	0,006	0,016
ROUTCONF	*M*	**0,070**	–0,076	–0,538
	SE	0,004	0,005	0,015
INTCONF	*M*	**–0,007**	–0,360	–0,333
	SE	0,004	0,006	0,016
HIGHCONF	*M*	**0,003**	–0,175	–0,092
	SE	0,004	0,006	0,016

Note: M: Adjusted Mean Score, *SE*: Standard Error, The numbers in bold are the biggest adjusted mean score for each dependent variable

Table 7. Pairwise Comparison Results of ANCOVAs

ANCOVAs follow-up to MANCOVA**																Univariate ANCOVA***		
INTUSE			PRGUSE			ROUTCONF			INTCONF			HIGHCONF			ATTCOMP			
	2	3		2	3		2	3		2	3		2	3		2	3	
1	*	*	1	*	*	1	*	*	1	*	*	1	*	*	1	–	*	
2		*	2		*	2		*	2		–	2		*	2		*	

Note: *: there is significant difference between related group mean scores, -: there is no significant difference between related group mean scores, **: In MANCOVA for other ICT indices, ESCS and ATTCOMP are taken as covariates, ***: In ANCOVA for ATTCOMP, only ESCS is taken as covariate, 1: EU Member Group, 2: New EU Member Group, 3: Turkey

Comparison of ICT use (Answer to Research Question 1)

There are two categories for types of ICT use in PISA 2003. The first category, Internet/entertainment use (INTUSE), involves using computers both for educational use (looking up information and communication) and for entertainment. The second category, program/software use (PRGUSE), involves using computer both for general purpose programs (like word processing or spreadsheets) and as educational software.

Considering the comparison of country groups in Internet/entertainment use, the statistical analysis (follow-up ANCOVA to MANCOVA) yielded a statistically significant result, but its practical significance could be accepted as small. Students in the new EU member group and Turkey use Internet at a very similar level, but less than those in the EU member group. When the effects of students' socioeconomic and cultural status and attitudes toward computers are taken into consideration, the adjusted mean of Internet/entertainment use of students in Turkey gets higher, but that of both EU groups goes down a little bit.

As to program/software use, statistical analyses also yielded significant results, but adjusted mean differences are not meaningful. All country groups have close adjusted means of program/software use. What is intriguing is that Turkish students' frequency of

program/software use is slightly higher than both EU groups, in spite of a striking inequality in the computer access rate at home and at school in favor of both EU groups.

Comparison of Self-confidence in ICT tasks (Answer to Research Question 2)
Self-confidence in ICT related tasks has three categories formed by PISA 2003 experts. The first category, self-confidence in routine tasks (ROUTCONF), is related to routine tasks on a computer, such as opening, saving, deleting, or copying files. The second category, self-confidence in Internet tasks (INTCONF), is related to Internet tasks on a computer, such as downloading files or music, or sending email with an attachment file. The final category, self-confidence in high-level tasks (HIGHCONF), is related to advanced computer tasks, such as creating multimedia presentations, preparing a webpage, programming, or using software to remove computer viruses.

First is confidence in routine tasks (ROUTCONF). Follow-up ANCOVA to MANCOVA yielded significant result for ROUTCONF. Practical significance is relatively higher and could be accepted as small effect sizes. 2.1% of variance in ROUTCONF could be attributed to status of country groups in EU when ESCS and ATTCOMP are controlled. Similar to the case in INTUSE, adjusted mean of Turkey's ROUTCONF rises from –0,671 to –0,538, while adjusted means of both EU groups fall a little bit. The considerable increase in ROUTCONF of Turkey could be attributed to eliminating ESCS effect. This means low ESCS of Turkish students negatively influences their self-confidence in routine ICT tasks, such as opening or saving a file.

Second is confidence in Internet tasks (INTCONF). When the effect sizes of follow-up ANCOVA (0.034) is considered, it is the most differentiating ICT aspect across country groups. After the effect of ESCS and ATTCOMP eliminated, the difference in INTCONF across country groups remains its significance. However, the negative effect of low ESCS conditions on INTCONF in Turkey is seen again.

Third is self-confidence in high-level computer tasks (HIGHCONF). Since the effect sizes for follow-up ANCOVA is less than 0.01, the difference among country groups in mean scores of HIGHCONF are not meaningful. In other words, they could be regarded as homogeneous across country groups. When adjusted means are interpreted descriptively, it is seen that EU member group have the highest mean of HIGHCONF score. Turkey and new EU member group are in the second and third order respectively but their means are very close to each other.

Comparison of attitudes toward computers (Answer to Research Question 3)
For the third research question, a univariate ANCOVA was conducted to investigate the relationship between the status of country group in EU and students' attitudes toward computers, holding ESCS constant in all country groups. ANCOVA was significant, F (2, 84671) = 80.399, p<.001, η^2 =.002 as seen in the Table 8. However, the effect size is too small, thus the differences in the adjusted mean scores of ATTCOMP are not practically meaningful. Nevertheless, if the post hoc tests are interpreted, there are significant differences between Turkey and the others. However, there are no significant differences between both EU groups when the effect of ESCS is eliminated (see Table 7). When descriptively evaluated, ATTCOMP in Turkey is higher than both EU groups. Turkey had the biggest adjusted mean score of ATTCOMP while EU member group and new EU member group relatively smaller and close means to each other in condition of ESCS controlled (see Table 9).

Table 8. The Results of One–Way ANCOVA

Dependent Variable	Covariate	*df*	Error *df*	*F*	*p*	η^2
ATTCOMP	ESCS	2	84671	80.399	<.001	.002

Table 9. Adjusted Mean Scores and Standard Errors of ATTCOMP

Dependent Variable		Country Groups		
		EU Member Group	New EU Member Group	Turkey
ATTCOMP	*M*	–.009	–.021	**.213**
	SE	.004	.006	.018

Participants' Perceptual Evaluations on Comparison of ICT Aspects across the Country Groups (Answer to Research Question 4)

Type of ICT use

Majority of participants associated relatively lower position of Turkish students in Internet/entertainment use with a lack of access to computers and Internet facilities due to the country's insufficient financial resources.

A relatively better position of Turkish students in program/software use was associated with computer courses in the curriculum and the existence of Computer Education and Instructional Technology (CEIT) departments, thus their graduates working as computer teachers in Turkey. Most of the participants stated that most probably, similar policies about integrating ICT into school curriculum, employing computer teacher (CEIT graduates) at schools resulted in similar program/software use across the country groups.

Self-confidence in ICT related tasks

In connection with self-confidence in ICT, Turkish students generally had lower self-confidence in ICT-related tasks, namely routine, Internet and high-level tasks. Most of the participants put forward a series of rationales or reasons why Turkish students have lower self-confidence in ICT related tasks. Their rationales can be ascribed to the general conception of a lack of internalization in computer-related tasks, which has the following interdependent dimensions: not feeling the need, reason or no purpose to use a computer, not sufficient and functional computer-related education, lack of individual computer access due to the high ratio of students per computer at schools, and having no home computer due to the low socioeconomic status (SES) of the family. Each dimension has its own effect on Turkish students' low self-confidence in computer related tasks. In addition to these, three participants called attention to the low self-confidence of Turkish students in computer-related tasks, due to using computers heavily for chat and computer games. Since chat and computer games do not require students to acquire many computer related knowledge and skills, they have low self-confidence in computer related tasks.

Self-confidence in routine tasks: Students in both EU groups are substantially more self-confident in routine tasks than those in Turkey. Three participants indicated that the Turkish students' reported program/software use contradicts their self-confidence in routine tasks. This contradiction is generally related to not doing computer tasks by oneself. In such a case, there is a curriculum including program/software use content and the students are introduced to computers as long as school conditions permit in Turkey; however, most of them have little or no chance to use computers by themselves at school. Therefore, their responses to questions on

frequency of program/software use are positive, but their responses to questions on self-confidence in similar tasks are negative. Some participants related low self-confidence in routine tasks to the low level of parental education and income in Turkey. Moreover, they also emphasized that the higher the level of parental education and income, the higher the self-confidence in routine tasks and the more conscious and functional computer use.

Self-confidence in Internet tasks: Most participants attributed the negative differentiation of Turkish students in self-confidence in Internet tasks to low level of individual access to and use of the Internet, due to the poor economic conditions of Turkey in 2003, the lack of basic computer competencies, the nonexistence of Internet related content in the curriculum in 2003, the delay in introducing Internet at schools, the limited Internet infrastructure at schools and the students' limited Internet use due to preparation for the central examination necessary to enter high schools.

Self-confidence in high level ICT tasks: Some participants related the lower position of Turkish students in self-confidence in high-level tasks to the nonexistence of high-level ICT tasks in the school curriculum in 2003, not feeling the need for advanced computer use by teachers and/or students, depending largely on low individual access to computers and the Internet, and on low personal interest and curiosity about advanced ICT tasks.

Attitudes toward Computers

The majority of the participants made causal explanations as to why Turkish students have more positive attitudes toward computers than students in both EU groups. Generally, most participants related Turkish students' more positive attitudes to cultural characteristics and to poor economic conditions. Four participants highlighted that the entertainment and gratification dimension of computer use in Turkish culture reflected positively on students' attitudes toward computers. Furthermore, it was stated that Turkish students are more inclined to computers than students in both EU groups. Moreover, most participants stressed that Turkish students have an extra aspiration, interest and curiosity about computers due to hungriness for technology and the image of computers in 2003 conditions of Turkish society.

DISCUSSION

Comparison of ICT use

Similar level of program/software use across the country groups may be related to two possible causes. Firstly, ICT is in the primary and secondary school curriculum in most of the EU countries (Eurydice, 2001, 2004) and Turkey (MONE, 1994, 1998, 2000). When collecting PISA 2003 data, most of the students (97.5%) were attending upper secondary schools in Turkey. Therefore, most probably those students were taking courses such as Computer 1–2 or Information Technology 1–2. The relatively higher position of Turkey in program/software use may be related to content of these courses, which include word processing, spreadsheets, and drawing and graphic programs (MONE, 1994, 2000). As Göktaş (2003) proposes, primary school curricula should include ICT as a must course.

Secondly, all country groups generally employ ICT specialist teachers (i.e. computer teachers) to reach ICT related objectives in the curriculum (YÖK, 1998; Eurydice, 2001, 2004). Eurydice (2001) informs that specialist ICT teachers teach students ICT as a separate subject in secondary schools in most European countries. With the restructuring of teacher education programs by YÖK in 1998, CEIT departments were opened to provide primary and secondary schools with computer teachers in Turkey (YÖK, 1998). CEIT graduates work as computer teachers in primary and secondary schools to teach students ICT skills in optional courses in

the curricula. Most probably, similar policies to employ computer teachers to provide students with ICT knowledge and skills across country groups result in similar frequencies of program/software use in these groups.

The result of similar program/software use can be interpreted as an indicator of an increase in ICT familiarization of Turkish students. Besides, it shows that IT rooms are used more with an increase in employment of computer teachers (Yalçınalp & Yıldırım, 2006). The current policy of employing computer teachers in primary and secondary schools should be continued, but the roles and duties of computer teachers should be redefined. They should not only teach students computer competencies in separate computer courses –which is what they are mainly supposed to do at school at present–, they should also be ICT coordinators acting as change agents and consultants in the integration of ICT into the whole curriculum.

As to Internet/Entertainment use, taking the discrepancy between students' socioeconomic and cultural status into consideration, the low socioeconomic and cultural status in Turkey seems to be a barrier limiting the level of Internet/entertainment use. Obviously, the primary cause of this situation appears to be low economic conditions negatively affecting access to computers and Internet at home, at school and in other places, in 2003. Since Gross National Income (GNI) per capita in Turkey is considerably lower than in both EU groups (World Bank, 2008; Yıldırım, 2006), there is a very low access rate to computers and Internet, especially at home and school, for students in Turkey (OECD, 2006). Furthermore, there are relationships between GNI per capita, population, and possession and utilization of ICT (OECD, 2006; Eurydice, 2004; Göktaş, 2003). In fact, there is a positive relationship between GNI per capita and possession/utilization of ICT, but there is a negative relationship between population, and possession/utilization of ICT. Considering the lower GNI per capita, the larger population size and the population growth rate of Turkey (World Bank, 2008), Turkish students seem to be in a disadvantageous position in terms of access to and use of computers and the Internet. In 2003, 69% of students in the EU member group had Internet access at home, while 28.5% of those in the new EU member group and only 14.4% of those in Turkey had home access (OECD, 2006). MONE initiated the Fast Internet Connection to Schools project in December 2003. Thus, until this project was to take effect, there was a lack of, or slow, Internet connections at schools (Akbaba-Altun, 2006) and the curriculum of computer courses generally did not include the objectives of Internet-related tasks in 2003 (MONE, 1994, 1998, 2000). On the contrary, parallel to their high Internet penetration at school, both EU groups generally have Internet related objectives in the curriculum (Eurydice, 2001, 2004). Moreover, there is a trend that the more access to computers at home, the more access to computers at school (Eurydice, 2004). In other words, as family income increases, access to computers and Internet at home and school increases.

What is common for the country groups is the proportion of students who have computer access in other places than at home and school (See Figure 1). Accessing computer and most probably also the Internet in other places is somehow independent from average welfare of country groups. However, using computers or Internet in other places reminds the phenomenon of Internet café in Turkey. Thus frequency of using it in those places may not be so frequent because students have to pay money. Since computer and Internet penetration in new EU member group and Turkey is relatively similar and lower, their students use Internet less frequently, whereas students in EU member group use Internet more frequently.

Comparison of Self-confidence in ICT related tasks

Developing self-confidence in ICT tasks involves engaging students in meaningful and purposeful tasks by oneself. This is related to computer access rate and integration of ICT

across curriculum. Firstly, there is a direct relationship between prosperity level of countries and the development of school and home computer facilities (Eurydice, 2004). It is known from the World Bank (2008) that GNI per capita are 23,173 for EU member group, 4,414 for New EU member group and 2,980 for Turkey in 2000 (in US dollars). GNI per capita increased to 34,648, 8,634, and 4,750 for EU member group, new EU member group and Turkey respectively in 2005. As GNI per capita increases, home and school computer possession indicators also increases. Then, it could be said that the discrepancy in GNI per capita underlies the gap of access and use of computer and the Internet.

The student-to-computer ratio should be minimized to one-to-one in computer courses. In order to achieve this, classes can be divided into two sections and one section can take another course concurrently while the other section is taking an ICT-related course in the IT room. Also, number of ICT related courses in a week should be increased; besides number of students in a course can be reduced by dividing them into two or three sections for ICT-related laboratory activities, so as to give opportunity to students to use ICT individually.

Secondly, integrating ICT into curriculum –with objectives to use ICT in an interdisciplinary manner or as a tool for enhancing knowledge and skills in other subjects– is particularly more common in the EU member group. Yet, as stated above, ICT penetration at home and at school is relatively lower in Turkey compared to both EU groups. Thus, students did not have chance to do individual work in computer courses or in other courses. Furthermore, curriculum in operation in 2003 did not cover using ICT as a tool in teaching other subjects in Turkey. Such attempts were appeared first with the curriculum reform initiated in 2004 (TTKB, 2004). Because of these reasons, Turkish students' self-confidence in ICT tasks is relatively lower than do students in both EU groups.

Self-confidence in routine tasks: The content of self-confidence in routine tasks exist more in the computer courses' curricula offered until 2003 than in Internet and high-level tasks in Turkey. Ironically, Turkish students have the lowest self-confidence in routine ICT tasks. This could be explained by two limitations of computer courses in Turkey. First, the curricula of computer courses include objectives not related to using computers in a functional and meaningful way, yet objectives, such as show the printer (MONE, 1998), and Apply file menu options and procedures (MONE, 2000) for general software programs such as word processor are common in the curriculum of computer courses. Second, most of the Turkish students have little or no chance to access and use a computer individually at school or at home, due to low economic conditions. Considering the large number of students in primary and secondary education in Turkey, students generally go to IT rooms for one or two hours a week in K-12 schools and usually more than one student has to share one computer for program/software and/or Internet-related tasks or activities. Use of one computer by more than one student brings about critical problems such as classroom management for teachers and lack of individual computer and Internet use for a majority of students. In this case, even if all of the students are likely to be aware of what is happening in an IT room, only a minority of them will probably have the chance to use computers or the Internet individually, while the majority has no or little chance. In such a case, it seems to be illogical to expect Turkish students to develop high self-confidence in routine ICT tasks.

Self-confidence in Internet tasks: There were no objectives related to the Internet in the curriculum of computer courses (MONE, 1994, 1998). The only exceptions are some objectives like searching for information on the Internet and using an email program at a basic level in the Computer 1 course (MONE, 2000). Furthermore, the Internet connections at schools were very limited and even if they existed, they were very slow (TBŞ, 2002; Akbaba-

Altun, 2006) until the Fast Internet Connection project was launched in December 2003. On the contrary, students' computer and Internet access rate in primary and secondary schools in both EU groups are considerably higher than that of students in Turkey (Eurydice, 2004; OECD, 2006; World Bank, 2008). Under these conditions, it is an expected result that Turkish students have relatively lower self-confidence in Internet tasks than students in both EU groups.

Self-confidence in high-level tasks: Turkish students feel less confident in high-level ICT related tasks than those in both EU groups. Yalçınalp and Yıldırım (2006) also state that Turkish students in PISA 2003 feel least confident in some high-level ICT tasks like using antivirus programs, designing webpage and programming, while they feel most confident in some routine ICT tasks like starting games, playing games and drawing picture with the mouse. The relatively higher mean of self-confidence in high-level tasks compared to the other two types of self-confidence could then, be due to preparing presentations, using spreadsheet programs and using database programs, all of which took place in the curriculum of computer courses (MONE, 1998, 2000).

Comparison of attitudes toward computers

There is one proficiency level difference in the means of mathematical and problem solving literacy performance between Turkey (at level 2) and both EU groups (at level 3) in PISA 2003. Therefore, Turkish students on average can be considered as lower achievers compared to students in both EU groups. Sweet and Meates (2004) also report a similar pattern for low achievers in PISA 2000 data: low achievers' perceived confidence and competence in using ICT are generally lower than their reported attitudes toward computers. This is actually as the case in this study for Turkish students: a higher attitude but a lower self-confidence in ICT tasks. The more positive attitudes toward computers of Turkish students can be exploited in the affective domain of pedagogy across the curriculum. More specifically, students with low motivation toward learning can be encouraged and motivated through educational computer games to learn other subjects. Besides, basic computer skills can be acquired by pupils through computer games.

CONCLUSION

In brief, new EU member group and Turkey have similar means of Internet use, self-confidence in Internet tasks and high-level tasks, whereas EU member group has considerably higher mean scores compared to the others. Turkey has considerably lower mean scores in routine computer tasks compared to both EU groups, but Turkish students' attitudes toward computers are higher than students in both EU groups. Self-confidence in routine ICT related tasks and Internet use are the most differentiating ICT aspects across country groups. Controlling attitudes toward computers and socioeconomic background of students did not change the results in comparison of country groups in ICT aspects. The most dramatic change is increase in Turkish students' adjusted means when the effect of ESCS and ATTCOMP are eliminated in all country groups. This means, the lower socioeconomic background of Turkey is a disadvantage for improving students' type of ICT use and self-confidence in ICT related tasks.

The policy makers gave some evaluative explanations to these comparative results. The cultural characteristics and poor economic conditions were stated by the participants as the reasons of relatively high position of Turkish students in attitudes toward computers. The computer courses in the curriculum and the existence of computer teachers (particularly CEIT graduates) were articulated as reasons of similar level of program/software use, while lack of

access to the Internet due to low economic conditions in Turkey was indicated as lower level of Internet use in Turkey. Finally, relatively low position of Turkish students in ICT tasks were related to the lack of internalization in computer-related tasks, which has the following interdependent dimensions: not feeling the need, reason or no purpose to use a computer, not sufficient and functional computer-related education, lack of individual computer use due to the high ratio of students per computer at schools, and having no home computer due to the low SES of the family.

It can be claimed that without self-determined, conscious, purposeful and meaningful use of ICT facilities individually, it is difficult to develop and improve self-confidence in ICT related tasks. Turkish students most probably had marked higher frequencies for program/software use items in the ICT questionnaire because of their routine visits to IT rooms for computer courses. Yet, when answering self-confidence in ICT related items, Turkish students could not be sure in doing certain tasks by themselves, such as opening a file, saving a file or deleting a file. Since ICT facilities did not become widespread and ICT was not integrated across the curriculum, most Turkish students could not practise what they had learned in computer courses; thus these tasks were not their routine activities yet. Developing self-confidence in ICT related tasks involves engaging students in more meaningful and purposeful ICT-related authentic tasks which should be undertaken by oneself. This is directly related to the computer access rate and integration of ICT into subjects across the curriculum. Therefore, such a result can be expected.

In order to lessen digital divide regarding overall ICT use and self-confidence in ICT tasks within Turkey and between Turkey and EU, the government or MONE should take measures to diffuse ICT with fast and secure Internet facilities at school, develop sound national and local ICT policies addressing how to integrate ICT across the curriculum with facilities at hand, and clear prescriptions to how to implement, monitor and evaluate ICT related policies, initiatives and projects.

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