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Gender and digital usage inequality among adolescents: A comparative study of 39 countries

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ABSTRACT

The paper investigates how gender exerts its influence on contemporary adolescents with respect to their access to the Information and Communication Technologies (ICTs). The focus here is on the so-called usage access. The paper's empirical basis is that of information on the ICTs usage collected for 39 countries in the framework of the 2006 wave of the Program for International Student Assessment (PISA) study. Ordinal regression modelling is used as a method for data investigation. The analysis points to the persistence of gender inequality seemingly in favour of boys. In all countries under investigation, boys report using computers and the Internet for educational purposes more often than girls. Controlling for the 2006 value of the national GDP per capita, the level of a country's gender inequality measured by the Gender Gap Index does not have any statistically significant effect on gender gap in educational use of ICTs. A sign of the gender coefficient suggest, however, that the increase in society's gender-neutrality is associated with the increase in boys' advantage over girls as regards the frequency of ICT/Internet educational use. The possibility that this advantage of boys is in fact a sign of their educational under-performance is discussed. Another possibility is also discussed, namely, that girls' decreased (in comparison with boys) frequency of using computers and the Internet for playing computer games might, counterintuitively, be the source of girls' disadvantage in the future.

1. Introduction

To what extent are the current usage patterns of Information and Communication Technologies (hereinafter ICTs) influenced by one's gender? Are girls lagging behind boys as regards the use of computers and the Internet? The present paper intends to address these questions with reference to adolescents living in the countries that, in 2006, administered the ICT Familiarity module in the framework of the OECD's PISA study.

One of the most striking features of the second part of the 20th and the early 21st century is the profound change that has taken place concerning the position and role of women in society. In all developed and in many developing countries, one can observe a steady trend towards gender equity in all areas of private and public life (Castells, 2001: 134–242). This transformation – or, as some prefer to put it, quiet revolution (Goldin, 2006) – is far from over, and its results in the form of a new shape of social order are not yet determined (Esping-Andersen, 2009). One can, however, discern even now the basic features of the emerging *nouveau régime*. Among these one can mention, for example, the increased participation of women in the labour force in general and their entry into traditionally male-dominated professional areas in particular (Meece, 2006).

With respect to such traditional men's bulwarks as ICT subjects and careers, changes towards a greater gender balance have been pronounced especially in recent years. Describing the situation in the 1990s one could still argue that in most industrialized countries, women appeared to be a minority in computer science (Anderson, Lankshear, Timms, & Courtney, 2008: 1305). In the meantime, She Figures 2009 report (European Commission, 2009) shows for countries of the European Union an increase of female participation in the field of computer science, although the gender imbalance in favour of men still continues to characterize this field of study. Even though the field of science, mathematics, and computing is still characterized by higher numbers of male PhD holders, in 2006 women constituted a large

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proportion of graduates in this area, too. Between 2002 and 2006, a particularly high growth rate in the number of female PhDs over that period was observed in computing. Similarly positive trends are reported for the United States. As two American psychologists summarize:

> there are no longer gender differences in the number of demanding mathematics courses taken in high school. Furthermore, girls do better, on average, than do boys in these courses, earning consistently higher scores. Second, (…) the proportion of women earning bachelor's degrees in scientific and engineering fields has increased. (…) Men and women earn equal grades in college math classes that are of comparable difficulty, and this has been true for a long time. Finally, (…) women major in mathematics in nearly equal numbers to men. In recent years, for example, women earned 48% of bachelor's degrees in mathematics. (…) (Ceci & Williams, 2010: 17–18).

Moving down the educational ladder, when it comes to contemporary adolescents – i.e., the age category studied in this paper – previous research shows a remarkable gender variation in mathematics-, science-, and literacy-related achievement patterns by country. For example, on the basis of data from the PISA 2003 study, Guiso, Monte, Sapienza, and Zingales (2008) looked at gender differences in performance across 40 countries. They found a positive correlation between gender gap in mathematics and gender equity (measured with the World Economic Forum's Gender Gap Index, which reflects economic and political opportunities, education, and well-being for women (Hausmann, Tyson, & Zahidi, 2006)). In more gender-neutral countries (such as Norway or Sweden) the math gender gap disappears and becomes statistically insignificant. Moreover, the gender gap in reading, which favours girls and is apparent in all countries, expands in more gender-neutral societies. Thus, Guiso et al. conclude that girls' underperformance in math relative to boys is eliminated in more gender-neutral cultures, except for geometry (where the boys' advantage relative to the girls' is the biggest) and arithmetic (where the boys' advantage relative to the girls' is the smallest). In more gender-neutral societies, girls perform as well as boys in mathematics and much better than them in reading.

With respect to gender differences in access to and use of the Internet, various studies conducted in the 1990s and the early 2000s on gender-related ICT differences among students at different levels of education showed a consistent pattern: female students were likely to have less positive perceptions of their computer competence and were less attracted to computers than their male peers (for the U.S., Busch, 1995; Nelson & Cooper, 1997; for Greece, Vekiri & Chronaki, 2008). They also appeared to use computers less frequently both inside and outside school (for Finland, Hakkarainen et al., 2000; for the UK, Mumtaz, 2001; a review article of various research studies conducted in the 1990s, Volman & van Eck, 2001). Additionally, a more recent investigation by Notten, Jochen, Kraaykamp, and Valkenburg (2009) based on a multilevel analysis of 30 countries taking part in the PISA 2003 study found that compared to boys, girls have 20 percent lower odds of having the Internet access at home, 34 percent lower odds of using the Internet for informational purposes, and 78 percent lower odds of playing games on a computer (Notten et al., 2009: 555).

More recent studies, however, draw a more gender-balanced picture. Thus, for example, Popovic, Gullekson, Morris, and Morse (2008) comparing the results from the Attitudes Towards Computer Usage Scale (Popovic, Hyde, Zakrajsek, & Blumer, 1987) obtained from undergraduate students at one of the universities in the American Midwest in 1986 and 2005, concluded that: 'many of the sex differences that were found in 1986 were not found in 2005. *Males and females no longer significantly differ in their attitudes toward computers, whereas they did in 1986*. Additionally, no significant sex differences were found in the number of college computer courses, the amount of time spent using computers, or on the amount of self-reported computer anxiety' (italics added) (Popovic et al., 2008: 991).

In Asia, Tsai and Tsai (2010), in their gender and geographically representative study of 1080 fourteen-year olds in Taiwan, found no gender gap in computer and Internet self-efficacy, with girls being more confident than boys regarding online communication. While the authors found significant gender differences in students' online purposes and Internet use intensity, they did not find any gender differences in Internet use experience and computer ownership. In other words, boys tend to use the Internet as an entertainment tool while girls tend to use it as a communication tool, while boys also use the Internet significantly longer than girls in terms of weekly time spent online (the authors attributed this result to the boys' higher interest in playing online or computer games). Boys and girls do not differ, however, in the Internet use experience in terms of years and in their opportunities of accessing the Internet. In another Asian study on computer attitudes among adolescents, no gender difference was found among eighteen-year old students (107 boys and 76 girls) enrolled at a post-secondary educational institution in Singapore (Teo, 2008).

In a European study, on the basis of their research on the accessibility and attractiveness of different types of educational ICT applications for boys and girls conducted in Dutch primary and secondary schools, Volman, van Eck, Heemskerk, and Kuiper (2005: 52) suggest that there are fewer gender differences in attitude regarding ICTs among younger pupils than among older pupils and that therefore – in a context of a technologically advanced society – one can expect the disappearance of such differences in future generations. With respect to slightly older ICT users, in their study of 23 female and 25 male students (most of them aged 20–25) from different departments at the University of Frankfurt, Imhof, Vollmeyer, and Beierlein (2007) found no gender differences in the measure of computer self-efficacy and no gender gap in study-related computer use, neither in terms of time spent at the computer nor in terms of preferred activities at the computer. They did find, however, differences between men and women concerning computer use for personal purposes and the kinds of uses for which they went online, with men using computers for personal or non-study activities more often. The authors also found a difference in computer performance, with men outperforming women on the assigned PowerPoint task that involved redesigning transparencies. The maximum number of points one could score on the task was 15, with men reaching the mean of 11.40 and standard deviation of 2.11 and women reaching the mean of 9.74 and standard deviation of 2.26 (with $t(37) = 2.38$, $p < 0.05$, and $d = 0.76$) (Imhof et al., 2007: 2833).

Thus, this literature review can be concluded by saying that one of the most robust findings in the previous research on gender differences in broadly understood access to ICTs is the fact that women (girls) use computers and the Internet in a different manner than men (boys). With respect to adolescents, it has been shown that whereas boys use computers and the Internet predominantly for 'solitary,' recreational purposes (e.g., playing games, downloading music, etc.) and are more interested in technical aspects of ICT; girls prefer to use computers and the Internet primarily as a communication medium (e.g., they e-mail and chat more intensively than boys) (Jackson et al., 2008; Jackson, von Eye, Fitzgerald, Zhao, & Witt, 2010; Kuhlemeier & Hemker, 2007; Tsai & Tsai, 2010; Volman et al., 2005).

For all the reasons stated above, it is also useful and interesting to carry out a comparative investigation on how gender exerts its influence on contemporary adolescents with respect to their access to ICTs. As some of the above-mentioned research suggests, gender