

‘RETURN TO GENDER’: GENDER, ICT AND EDUCATION

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BACKGROUND PAPER

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1. Introduction

OECD's Centre for Educational Research and Innovation (CERI) started in January 2007, the New Millennium Learners (NML) – project. The main object for this project is to conceptualize and analyze from a comparative perspective views, attitudes, expectations and competences of Millennials in relation to learning and teaching, and, on the contradiction that may be perceived between what their daily practices involving communication and knowledge management in and outside classrooms are. As a part of this, gender issues appear relevant and these will be brought into focus when the OECD together with the Norwegian Ministry of Education and Research organize an Expert Meeting on Gender, ICT and Education, on 2-3 June 2008 in Oslo.

2. Background: Why gender?

2.1 *There is a gender gap; in education and elsewhere in society*

Research shows that gender gaps exist all over the world, in all segments of society, but with cultural variations across the nations. The latest *Global Gender Gap Report*, published by the World Economic Forum, shows that no country in the world has yet reached equality between men and women (Hausmann, 2007). The Gender Gap Index assesses countries on how well they are dividing their resources and opportunities among their male and female populations, regardless of the overall levels of these resources and opportunities¹. The highest ranking country has closed a little over 80% of its gender gap while the lowest ranking country has closed a little over 45% of its gender gap. Sweden (1) Norway (2), Finland (3) and Iceland (4) top the rankings on the list. All countries in the top 20 made progress relative to their scores last year – some more so than others. The Report covers a total of 128 countries, representing over 90% of the world's population (Hausmann, 2007).

In the field of technology, there is also empirical evidence to suggest the continuance of male domination; men use computers and the Internet more than women, men have wider computer experience, spend more time online, report greater interests in and positive attitudes towards computer-related activities, and even appear to be more motivated to learn digital skills (Arnseth, 2007; Broos, 2006; Selwyn, 2007; Smihily, 2007).

This gender gap concerning technology is also to be reflected among young people, both in an educational setting and elsewhere. Research on ICT, gender and education identifies gender differences in several fields, like learners' performances, attitudes towards computers and skills as well as the impact of teachers, parents and peers (Arnseth, 2007; Faulkner, 2007; Law, 2008; Lenhart 2008; Lenhart, 2007; Macgill, 2007; Meelissen, 2008; OECD, 2007, 2008; Pedró, 2007;

¹ The Global Gender Gap Index provides a comprehensible framework for assessing and comparing global gender gaps and by revealing those countries that are role models in dividing these resources equitably between women and men, and it serves as a catalyst for greater awareness as well as greater exchange between policymakers. The Index examines the gap between men and women in four fundamental categories; economic participation and opportunity, educational attainment, political empowerment and health and survival.

Smihily, 2007; Vekiri, 2008).

These differences between the genders in terms of time consumption, frequency and patterns of use of ICT have often been interpreted as a possible explanations for why girls do not choose education in computing nor become ICT professionals (Alajaaski, 2006; Anderson, 2007; Beavis, 2007; Meelissen, 2007; van Welsum, 2007). As a consequence, much of the focus has been on what kind of efforts that have to be taken into action to help girls reach the same level as boys within the field of ICT.

Furthermore, these assumptions might also be related to the discourse that appears to have been dominating the gender issue for a long period of time in many of the OECD countries and elsewhere, namely that the girls are falling behind the boys when it comes to skills, performance and attitudes towards ICT (Corneliussen 2003, Meelissen 2007). Moreover, there is no general consensus yet on how to disentangle this gender issue, and in which ways educational policymaking and practices might succeed in bridging this gap.

2.2 Why bridge the gap?

There are several reasons for bridging the gap on gender and ICT in both its broadest sense in society, and within the field of education in particular. From an equity point of view, women need to fully participate in all aspects of society and economic activity. Second, from an efficiency point of view, women need to be part of economic activity at all levels, from decision-making to execution phases, and this is becoming increasingly urgent in the light of demographic pressures and aging populations in most OECD countries. Furthermore, there is a need to ensure a wide base of ICT skills to drive and enable ICT-related growth and productivity gains, contribute significantly to the design of new products and widen the user base. ICT constitutes both a goal and a tool for increasing participation of women in society and in the workforce (van Welsum, 2007).

It is crucial to highlight the gender gap in the field of education for several reasons. First, gender segregation in regard to choice of education and career is still strong; in the Nordic countries girls are, on average, attaining higher marks than boys in all subjects, except physical education; in addition girls are approaching 60% of university student population (Hegna, 2005; Nordahl, 2007). Reports also indicate that boys experience more problems in school, drop out of school to a higher degree than girls, and this appears to be a problem in many countries (Björnsson, 2005; Nordahl, 2007; OECD, 2006).

PISA 2006 reports gender differences in reading skills and mathematics among students at the age of 15. In all OECD countries the girls score highest in reading. In mathematics the performance advantage of males is unchanged from 2003 to 2006. Only in science there appears to be no significant difference between boys and girls (OECD, 2007). Other quantitative studies like TIMMS and PIRLS confirm these findings on skill-related gender differences also to younger students; for example do girls have better reading skills than boys at the age of nine (I. V. S. Mullis, . Martin, M., O., Kennedy, A., M., & P., 2007; I. V. S. Mullis, Martin, M. O., Gonzalez, E. J., & Chrostowski, S. J., 2004a, 2004b).

Moreover, we do know that children's preferences and patterns of use are influenced by, to

some extent, gendered socialization processes, and those might influence future gendered educational and career patterns (Margolis, 2003; Vekiri, 2008). We also do know that young people are using ICTs as tools to develop themselves as gendered subjects and even to position themselves in this way (Carr, 2005; Enochsson, 2005; Heemskerk, Brink, Volman, & ten Dam, 2005; Tønnessen, 2007). What appears to be striking is therefore to highlight these phenomena and try, in different ways, to broaden our views on gender, in order to go beyond the traditional and to some extent, homogenous way of approaching this issue. This is a central objective within the NML-project.

2.3 The New Millennium Learners (NML) - generation

The main object of study in NML is to conceptualize and analyze from a comparative perspective views, attitudes, expectations and competences of Millennials in relation to learning and teaching. A certain focus is on the contradictions perceived between their daily practices involving communication and knowledge management in and outside classrooms. To some extent, as will be shown, there is some kind of homogeneity within the NML-generation in all of the OECD member countries, although this homogeneity is largely influenced by the local context within the regions and countries. However, an important observation is the appearance of a stereotypification of boys and girls across most of the the OECD countries. Two issues emerge out of this, namely; 1) Why is it so? and 2) How can researchers and policymakers deal with this? This background paper aims to address those two issues and, to some extent, also to give some proposals for future policymaking within the field.

This approach might be summed up as boys and girls *and* ICT, in where the main focus is on girls and boys as users. The paper will only to some extent focus on women and men *in* ICT; that is within the ICT professions. The reason for this is that the NML-project mainly concentrates on young people and education, and only to a limited extent includes higher education and adults. Furthermore, due to the fact that the topic Women and men *in* ICT is rather wide reaching and an important field in itself, it is suggested that this be left as a separate research area. However, as will be highlighted throughout the paper, the two topics are deeply connected, since children's preferences and patterns of use are influenced by, to some extent, gendered socialization processes, which might contribute to future gendered educational and career patterns.

3. Gender and ICT in the field of education

There is empirical evidence to show that young people's use of computers at home has a positive impact on their educational outcomes (Beltran, 2008; Espinosa, 2006). Moreover, PISA 2006 and other studies, as Eurostat, show a gender difference in the use of and time spent with computers; where the boys appear to dominate (OECD, 2007; Smihily, 2007). The results highlight some challenges schools are facing in order to avoid a new digital divide between the genders.

Furthermore, boys use computers and the Internet more than girls, have wider computer experience, spend more time online, report greater interest in and perceive more positive attitudes to computer-related activities. Boys are also more motivated to learn digital skills (Arnseth, 2007; Broos, 2006; (OECD, 2003, 2007); OECD & PISA, 2005). On the contrary, girls appear to be dominating in the communicative field of ICT, like word processing, text messaging on cell

phone, as well as e-mail and blogging (Lenhart, 2007; OECD, 2007; Pedró, 2007). Moreover, in most western countries the proportion of women in computer science and in ICT related professions is static or declining, even in cases of sustained inclusion efforts (Falkner and Lie, 2007).

3.1 Discourses on gender and ICT

The differences between the genders in terms of male dominance in time consumption, frequency and patterns of use of ICT have often been interpreted as a possible explanation for why girls do not choose education in computing nor become ICT professionals (Alajaaski, 2006; Anderson, 2007; Beavis, 2007; Meelissen, 2007; van Welsum, 2007). As a consequence, much of the focus has been on what kind of efforts that have to be taken into action to help girls reach the same level as boys within the field of ICT.

Behind this lies an understanding that the girls are falling behind, in terms of not performing in the same way, nor show the same enthusiasm towards ICT as the boys. Meelissen and Drent make an interesting point when they highlight the fact that this discourse is only valid if one considers the boys' use as the norm and as a representative of the actual goals to reach (Meelissen, 2007, 2008).

Some researchers, for instance Sørensen, Jøsok Gansmo and Lagesen also highlight and even challenge this claim, that the girls are falling behind the boys, for instance (Gansmo, 2004; Gansmo, Nordli, & Sørensen, 2003; Lagesen, 2008; Sørensen, 2002).

However, most research has actually been based on this point of departure, which supports the view that the girls are falling behind the boys, when it comes to ICT; in terms of self attainment, attitudes, patterns of use and so on. And there have been numerous studies, both quantitative and qualitative that support this claim. This paper aims to present some of the recent findings on gender and ICT and as far as possible discuss in which ways it might be possible to move on from this, both in terms of research areas as well as in policymaking.

3.2 The role of the school and teachers

There is empirical evidence to suggest that youngsters use of, and attitudes towards ICT are deeply connected to their development of identity as gendered subjects (Carr, 2005; Tønnessen, 2007). Given this, an important issue is to question in which ways schools and teachers manage to include everyone in their pedagogical practice. One possible way might be to identify youngsters' attitudes and skills.

a. Boys' and girls' attitudes towards ICT

In all of the OECD countries, there appear to be differences in boys' and girls' attitudes (engagement, self attainment and motivation) towards ICT. Boys have a more positive attitude towards computers, less computer anxiety and more computer confidence than girls (A. T. Durdell, K. , 1997; A. T. G. Durdell, P., & Siann, G., 1995; OECD, 2007; M. Volman, van Eck, Heemskerk, & Kuiper, 2004). Boys are also more confident in success and perceive a higher degree of control than girls do (Arnseth, 2007; Enochsson, 2005; Kirriemuir, 2004; Kristiansen, 2004; OECD & PISA, 2005; Oosterwegel, 2004; Sølvsberg, 2003). Volman and Eck and Volman

et al. also found that girls answer general questions about ICT attitude less positively than boys, but are enthusiastic about applications like word processing and drawing (M. Volman, van Eck, Heemskerk, & Kuiper, 2005; M. E. v. E. Volman, 2001). Kent and Facer confirm these findings when they report that girls showed preferences in writing when using computers (Kent & Facer, 2004).

In examining the use of computers at school from an end-user perspective and focusing on what is good and bad about school computing, Colley found that the two worst aspects for younger students were computer problems and the boredom associated with undertaking work on computers. Both girls and boys agreed upon the frustrations connected to computer problems, but boys dominated when it came to boredom associated with working on the computers (Colley, 2003). Colley interprets these findings in terms of young boys being experienced users of computer games at home, and they appear to have a playful approach to computers and this approach does not necessarily reflect the use of computers at school.

b. Attitudes towards subject related use of ICT

Subject-related use of ICT in classrooms appears to have both positive and negative effects when it comes to attitudes, in terms of motivation towards the subjects. Research findings both confirm and refute a gender effect on attitudes when the use of ICT is related to particular subjects.

In the ICT Test Bed project in the UK, student motivation and engagement in learning and education were greatly increased by access to ICT (Somekh, 2006). Exceptional gains in writing standards by pupils in year 4 and year 5 of the project were considered by teachers to be mainly due to gains in the motivation and hard work of boys. This was considered a result of the support that ICT gave boys (as well as girls) in the writing process and their consequent gains in self-esteem.

Murphy, Beggs and Carlisle found that in UK, girls appeared to be more positive about their enjoyment of science. They also report that increasing the amount of practical, investigative work in science, particularly when using ICT had a marked, positive effect on their enjoyment of science and they demonstrated a significant reduction in the effects of age and gender on children's science attitudes (Murphy, 2003).

Meelissen and Drent claim that the use of ICT during mathematics lessons may reinforce gender differences in attitudes toward both mathematics and ICT. They refer to a study in the Netherlands, which shows that primary school girls appear to have less positive attitude toward mathematics than boys (Meelissen, 2007). Moreover, these findings are confirmed by Colley, who found a remarkable dislike of spreadsheets and databases by older girls, when they were asked about preferences for specific applications. These applications were the closest to mathematics or programming of those which were commonly used, and Colley sees the association between computers and math as relevant in confirming early findings on gender differences in computer.

c. Gender differences in attitudes towards ICT between young and old children

There is evidence which confirms a gender specific difference in attitudes towards ICT,

where in boys reveal more confidence than girls, but we do not know how and when this gender difference on attitudes starts. Research is contradictory when it comes to boys' and girls' perceptions and attitudes towards ICT in primary school.

On the other hand, research suggests that there exists particular gender differences in attitudes and confidence towards computers between older children. These differences can be summarized in that girls recognize their importance for work, while boys are more concerned with playing games or having restricted access to machines.

Volman and van Eck studied participation, ICT skills and learning results in primary and secondary education in the Netherlands. In their questionnaire and interviews, including 213 pupils, they found that there were no considerable differences between boys and girls in primary education (M. Volman et al., 2005). However, in secondary education gender differences appeared to be considerable. The differences were related to girls' preferences to applications related to communication and esthetics (M. Volman et al., 2005).

Similarly, another Dutch study, conducted by van der Mey, found no main gender-linked differences for attitudes towards functional uses of computer mediated communication between boys and girls of elementary school age (Mey, 2007).

North and Noyes assessed computer attitudes and cognitions of 104 children aged 11 and 12 via self report questionnaires in England. They found that the impact of psychological gender in general did not influence attitudes nor cognitions towards computers (North, 2002).

Kay and Knaack examined individual differences in the effectiveness of using digital media in secondary school classrooms covering 850 students in Canada. They did not find any gender differences concerning student attitudes or performance (Kay, 2008).

On the other hand, Colley compared boys and girls at age of 11-12 years to boys and girls at the age of 15 -16 in the UK concerning their perceptions of the best and worst aspects of computing at school, and she identified gender differences at both stages of age. Girls were oriented towards work and liking e-mail and boys showed a greater affinity with computer games and the mastering of computers (Colley, 2003).

Kent and Facer confirm the preferences of gaming for the young boys, but they also found that the significance of school related activities as older age groups move away from games play and increasingly use home computers for school work over time (Kent & Facer, 2004)

Volman et al. also found that in secondary education, the computer attitude of girls seemed to be less positive than that of boys, and girls and boys take on different tasks when working together on the computer and they tackled ICT tasks differently (M. Volman et al., 2005).

However, in her study conducted in secondary schools in Norway, Sølvsberg found that the effect on gender on control beliefs could depend on one's computer training and previous experience with computers. As a consequence, she showed that computer training contributes to stronger control beliefs for females, indicating that educators should encourage them to gain more experience with computers (Sølvsberg, 2003).

Sølvberg identified gender differences in control beliefs, intrinsic motivation and use of computers in her study (Sølvberg, 2003). Girls were less motivated, more anxious, used a home computer less and were unsure of their control beliefs, compared to boys. Volman and Van Eck did a similar finding on pupils in secondary schools in the Netherlands. They found that in secondary education boys said more often than girls that they knew more about computers than their teacher; and the boys also wanted to know more about computers and were more interested in them; they said more often than girls that they like lessons in which computers are used and they experience more control of the computers than girls (M. Volman et al., 2005).

Enochsson confirms this as she also found that boys were talking about their Internet knowledge to a greater extent than girls. She claims that this finding interplays with boys' reflections about the Internet's reliability (Enochsson, 2005). Enochsson conducted an ethnographic study in a Swedish classroom which was aimed at understanding what young students (age 9 to 11) do when they search for information on the internet at school and how they reflect on this when they are given the opportunity to work with it for a long period and with good guidance (Enochsson, 2005). Her study somehow confirms previous research within the field; boys show their interest in technology and girls do not seem to have the same interest in showing their interest. She also found that girls did seem to have an interest in technology and use computers as much as the boys. Enochsson concludes that there seem to be incongruence in what students say and what they do.

Results from an Australian survey, Girls and ICT survey, which was a phase of a three year study investigating factors associated with low participation rates by females in education pathways leading to professional level information and communications technology (ICT) professions, demonstrated that senior high school girls tended to perceive advanced computing subjects as boring and they express a strong aversion to computers (Anderson, 2007).

d. Digital skills

The Norwegian PIRLS results from 2006 show that boys are outperformed by girls in basic reading skills (van Daal, 2007). As shown, this is not only in Norway; all OECD countries report the same discrepancy in reading skills. Also PISA 2006 documents that at age 15, girls outperform boys in reading. However, results from the Norwegian PIRLS show that boys and girls have common skills in reading and interpreting information from the Internet. Van Daal, Gees Solheim, Noettaasen Gabrielsen & Begnum (2007) suggest including more extensive use of computers in school to stimulate boys' interests in reading, in order to improve boys' attitudes and skills towards reading, by integrating ICT in the pedagogical practices.

As for writing, both boys and girls write a lot, but apparently they prefer different genres, both on paper and digital. Moreover, they do not consider digital writing as 'proper' writing. A recent study from the US also shows that girls, and older girls in particular, dominate in writing, both at school and elsewhere, and older boys are most likely to write less. However, at school, the differences between the genders are diminishing (Lenhart 2008). Outside the school context, 49% of the girls reported that they write diary, while 20 % of the boys on the other hand reported that they would most likely not write at all outside school. Lenhart et al. highlight that the teenagers themselves consider writing as central to success and that school might contribute more than today's situation. The study is based on the situation in the US, but the situation might be similar

in other OECD countries as well. This way, schools are facing some challenges in order to include digital genres as a way to meet youngsters skills and motivations.

In a national survey of ICT-use and pupils digital literacy in Norway, Arnseth, et al. (2007) found gender differences in that girls report that they master finding information as an important aspect of digital literacy while boys report that they master production of digital texts and multi media as an important aspect of digital literacy. Girls, more than boys, report that they are concerned with learning as much as they can at school, that is, they take a more offensive approach to mastering in their attitude towards school work (Arnseth, 2007). Also Kent and Facer highlight girls' interest in the use of ICT connected to school work (Kent & Facer, 2004).

Volman found that girls in primary school enjoyed explaining to others what they can do well on the computer more than boys. Boys, on the other hand, found it more enjoyable to beat someone at a computer game, while for girls it was more important to use their creativity with the computer. The study also revealed gender specific differences in secondary schools, when using different applications girls dominated and showed most enthusiasm when using communicative-oriented tools, like creative writing, team work applications and so on. Boys, on the other hand, appeared to be more explorative in their use of ICT (M. Volman et al., 2005; M. E. v. E. Volman, 2001).

Kennewell & Morgan found in a study of young children in the UK that there is some evidence that computer gaming can generate a self-efficacy with technology, which can increase attainment in other aspects of use (Kennewell & Morgan, 2006).

This highlight other findings which claim that the use of computer games in schools seems to have a positive impact on engagement, and, in particular, on school drop outs, who very often happen to be boys (Kirriemuir, 2004). As mentioned, there is evidence confirming boys' preference for games, both in school and at home.

Colley suggests that younger students, particularly girls, would benefit from more support for their lower skill levels. She claims that this could help offset any gender differences in the experience brought to the classroom from the home environment. Because young students, and particularly boys, are heavily exposed to the excitement of computer games, there is a risk that more mundane tasks appear more boring in comparison (Colley, 2003). She continues by suggesting that it might be possible to engage their interest more fully by using a careful design of learning tasks and choice of software.

Van der Meij found that boys' and girls' topical preferences were similar rather than different in his study of the use of e-mail in education by 11 year old children (Mey, 2007). The students operated in mixed groups and all groups appeared to be sufficiently motivated to stay task-focused in their communication. He claims that the embedding of e-mail in classroom practices played an important role regarding the rather successful outcome; the combination of task and medium use in the setting triggered task focused behavior for boys and girls alike (Mey, 2007).

PISA 2003 found that students who are the most computer literate and ready to use computers in many parts of their lives might be expected to have certain advantages as a result. However, this evidence suggests that it is risky to assume that in every case it is associated with improved school performance (OECD & PISA, 2005). It is also to be mentioned that the survey is

not gender specific in this field.

e. Individual and collaborative learning

As briefly showed, there seems to be a slight tendency towards boys showing their preference to individual learning with ICT, whereas girls are more likely to prefer collaborative learning. However, the picture is more nuanced.

Prinsen, Volman and Tervel studied and reviewed research on gender differences in students's degree and type of participation and their learning outcomes in two particular collaborative activities using ICT in education, namely Computer Mediated Communication (CMC) and Computer Supported Collaborative Learning (CSCL). Interestingly, they found studies into CMC showing that male dominance and gender differences in communication style continued to play a role in such settings, even when CMC is characterized by its communicative capacity and therefore might be expected to be found more attractive to female students (Prinsen, 2007). They also found that participation was more gender balanced in educational settings with an explicit focus on inclusiveness in collaboration. Also when reviewing studies in CSCL they identified a tendency for boys to be more active participants in such computer assisted environments than girls, but the difference were less pronounced than in CMC. The authors suggest that one possible explanation might be that the studies in CSCL were run in real classroom settings, and that this was not always the case in the CMC-studies. Most studies they reviewed were small scale.

f. Teachers and ICT

We are of course aware of the teachers' role within education, what we do not know so much is if their gender has any kind of impact on the learners and their approach to ICT. At this stage, there is little empirical evidence which might indicate that schools or teachers are able to influence girls' and boys' attitudes toward ICT.

Recent findings from a SITES 2006 study, which focuses on pedagogy and ICT use in schools around the world in math and science, concludes, for instance, that despite more systems having higher percentages of ICT-using male teachers for both teacher populations, the gender imbalance is probably not due to gender specific differences in the pedagogical adoption of ICT. The authors, claim that any such difference is more likely to relate to social, historical, cultural and other contextual differences between male and female teachers in the specific education systems (Law, 2008).

Some findings, however, indicate that a teacher's gender does matter when it comes to their appearance as good role models. Using the data of a Dutch large-scale survey on ICT use in primary education (almost 4000 grade 5 students), Meelissen and Drent identified two school related factors which turned out to have a small positive effect on the computer attitude of girls; a teacher-centered pedagogical approach and computer experience of female teachers (Meelissen, 2007). The survey also showed that even if female teachers show the same intensity and the same variety in ICT use for educational purposes, they were less convinced about their ICT knowledge and skills than their male colleagues. Neither the intensity nor the variety of the teachers' ICT use for educational purposes had an effect on students' computer attitudes. In this perspective, Meelissen and Drent claim that teacher trainers should not only pay attention to their students

awareness of gender differences in computer attitudes and computer use of primary school children, but they should also focus on gender differences in self-confidence in ICT use of future teachers (Meelissen, 2007).

This perspective is to some extent supported by Smeets (Smeets, 2005). He found that teachers who valued ICT as a means to support pupil's active and autonomous learning, and who were confident about their skills in using ICT, were more likely to use open-ended types of ICT in their teaching practice. In this study, Smeets found that male teachers appeared to favor this type of ICT (open ended) than female teachers did (Smeets, 2005). Also, other small scale studies indicate that male teachers appears to have more confidence in their ICT skills: Kennewell showed that male teachers' competence levels were higher in computer games and the use of computer games for teaching purposes at school (Kennewell & Morgan, 2006) and back in 2001 Volman and Eck refer to similar findings in their review of gender equity in ICT and education (M. E. v. E. Volman, 2001).

Antonetti and Giorgetti, on one hand, claim that gender affects only the overall attitude towards computer use, self-evaluation of computer skills but not opinions about specific issues related to the role of multimedia in instruction (Antonetti, 2006). They even suggest that it is likely that attitudinal differences between males and females are overwhelmed by common professional interests and competences in the perspective that teachers who work in the same socio-cultural environment are faced, irrespectively on their gender, with the same educational problems, are involved in the same practices, are trained according to the same pedagogical principles and so on. And this leads them to develop more or less the same conceptions about the instructional tools that can be employed (Antonetti, 2006).

A national survey on the use of ICT in Norwegian schools, ITU Monitor 2007, shows that there are great differences between what teachers think they are focusing on in their lessons and what the pupils think of their own digital skills (Arnseth, 2007). These discrepancies and lack of a shared understanding of terminology between teachers and learners might influence the learning situation.

g. Parents' influence

Parents do have influence on children and young peoples' use of ICT, both in terms of encouraging ICT use, for instance in homework, and in general. PISA 2006 shows us that the parents' socio-economic status (SES) influences children's access and use of ICT at home and also to some extent influences their schoolwork (OECD, 2007). However, there has not been much research dedicated to find out much about their possible influence on transferring their own perspectives on gender and ICT to their children. One recent study conducted by Vekiri and Chonaki, concludes that parental support and, to some extent, also peer support are the most important variables for both boys' and girls' self efficacy and value beliefs towards computers (Vekiri, 2008). Their work consists of a survey including 340 fifth and sixth-grade students from seven elementary public schools in Greece. They relate their findings to previous research which indicate that parents hold stereotypes about the abilities of males and females in male typed domains and communicate different ability and behaviour expectations to their sons and daughters (Margolis, 2003). In addition, they claim that the expectations that parents communicate to their children can have long-term consequences as they have a strong effect on children's future self

efficacy beliefs, academic choices and career plans. In their study, they found gender differences in the level of support that students perceived to have from their parents and friends to learn about computers (Vekiri, 2008).

As already reported, we do know that boys and girls show different attitudes towards ICT, and show different preferences within the ICT possibilities. An interesting observation in this perspective is when the German speaking member countries of the OECD report that fathers are most likely to be the one who buys games for the children, whereas the mothers appear to be supporting their children with educational software.

Livingstone and Bober found that children in the UK, who are daily and weekly users, have parents who also use the Internet more often and have more expertise. These tend to be middle-class teenagers and those with home access to computers. They found that greater online skills are associated with the take-up of a wide range of online opportunities for children and young people, and a divide is growing, not just of access, but also centered on the quality of use. For some, the internet is a rich, stimulating resource, for others, a narrow, unengaging medium (Livingstone, 2005).

Broos and Roe report that the educational status of young peoples' mothers influences their use of computers. Broos and Roe connect these findings to previous studies to other forms of media use, for example the TV use of 9-12 year old children, and they underline the importance of incorporating this variable in future theoretical models (Broos, 2006).

A recent survey from the US shows that teens and their parents often have similar technological profiles in the gadgets they use and the frequency with which they use them. Teens, however, are notably more likely than their parents to say that the Internet and related technology has made their own lives easier. In the study, 89% of online teens said the internet and other devices in their lives, like cell phones, iPods, and digital cameras, make their lives easier, while 71% of their parents say these technologies make their lives easier. Furthermore, while a majority of parents with online teens still believe the internet is a beneficial factor in their children's lives, there has been a decrease since 2004 in the number of parents who believe the internet is a good thing for their children (Macgill, 2007).

As already mentioned, Vekiri and Chornaki showed in their study that parents' encouragement and expectations towards their children are more important predictors of children's self-efficacy and value beliefs than children's own activities; "(...) what parents communicate to their children about their children's abilities and activities has a more powerful influence on children's beliefs about their own learning than what children actually do or are able to do" (Vekiri, 2008).

h. Peers' influence

At this stage, the present paper has not succeeded in identifying research evidence on gender peer effects and the use of ICT in schools. However, due to the fact that we have recognized girls' preferences towards communication-oriented use of ICT, one could assume that their collaborative skills were appreciated in peer situations, but, as far as this paper has been able to map the situation, there appears to exist little research which focuses directly on peer, gender and ICT. Some findings that might be of relevance are reported. Kay and Knaack found that students

who were more comfortable about computers, appreciated the use of digital media in education more than their less confident peers, but the performance was unaffected (Kay, 2008). Vekiri and Chronaki found that the parents' influence was far more important than peers' when studying boys' and girls' use and perception of computers, both at home and school (Vekiri, 2008).

3.3 Youth culture; Web 2.0 and gaming

New emerging ICT related activities appear to attract boys and girls differently. What we can learn from some of those activities, namely gaming, blogging and social networking - in the process of developing attractive pedagogical practices with the use of ICT?

a. The NMLs and web 2.0: from consumers to producers of content

During the last few years there has been an increasing use of so-called content creating activities on the Internet. Web resources like YouTube, Flickr, MySpace, Facebook and Wikipedia as well as weblogs and fan fiction sites and so on are engaging to young people. These content creating activities have been framed in the concept called Web 2.0. What all these resources have in common is that it is the participants themselves who are in charge of the content by, for instance, posting video clips, photos, written texts, editing photos and drawings or even participating in social networks. Most of the activities connected to these resources are being done outside a school context; most likely at home.

As will be shown, there appear to be differences in what boys and girls prefer to do within these resources. Whereas boys most likely show their preference to practice of posting video clips on the web, girls appears to dominate in other multimodal fields such as like in weblogs and in social networks, including posting text and still photos and/or graphics.

Weblogs are dominated by young people, and, until recently, there appeared to be no significant gender difference between the blogging activity. A study of 203 randomly selected weblogs found that 54% have male authors and 46% have female authors and that 40% of blog authors are under age 20 (Herring, 2004). In 2003, Blog Census randomly sampled 490 000 Anglophone blogs to find 40 % male and 36 % female, with the rest of the blogs unidentifiable in terms of gender.² In other words, there did not appear to be any gender specific differences in the number of bloggers. Without identifying age in their survey, they found that males dominated the political commentary blog category and women, on the other hand, were in majority within the personal diary category. Gender differences were apparent in the content of the blogs, even if the blogging activity itself appeared to be even between the genders.

In 2006 Pew Institute found that while boys dominate in posting video clips, the girls appear to be more active with blogs. In their survey from USA, including 935 parent-child pairs at the age of 12 – 17, they found that 64% of online teens ages 12-17, had participated on one or more content creating activities on the Internet, up from 57%, in a similar survey in 2004 (Lenhart, 2007). In this study Lenhart also found that girls appear to dominate most elements of content creation:

² www.blogcensus.net/weblog

Some 35% of all teen girls blog, compared with 20% of online boys, and 54% of wired girls post photos online compared with 40% of online boys. Boys, however, do dominate one area - posting of video content online. Online teen boys are nearly twice as likely as online girls (19% vs. 10%) to have posted a video online somewhere where someone else could see it. (Lenhart, 2007).

The US survey also shows that girls are dominating within social networks, and that there appears to be a group of super users, which is also girl dominated:

There is a subset of teens who are super-communicators -- teens who have a host of technological options for dealing with family and friends, including traditional landline phones, cell phones, texting, social network sites, instant messaging, and email. They represent about 28% of the entire teen population and they are more likely to be older girls (Lenhart, 2007).

The results from the Pew Institute about the situation in the US reflect a similar tendency in Norway. A recent national survey has mapped teens at the age of 17, and their use and attitudes towards social networks confirms this tendency (Storsul, 2008). Also in this study girls dominate in the field of writing, posting still photos and the like, whereas the boys apparently prefer to post and download videos.

Lenhart's findings from the US also seem to correspond with Broos and Roe, who, in their study of 1145 Flemish adolescents, found that the frequency of Internet use of young females is socially and psychologically more complex than that of young males. Bros and Roe relate their findings to previous research (i.e. Rosengren and Windahl, 1989), which pointed at a similar trend in media use in general and not related to computers. As a consequence, Broos and Roe suggest that future research needs to develop separate theoretical models for males and females.

Interestingly, the German speaking areas in the OECD countries report that young people so far appear only to use the web 2.0 passively, but that there seems to be a trend toward an increasing participation in these activities, particularly concerning blogging and podcasting. In contrast to findings reported from the US and Norway, where girls seem to dominate the blog sphere, it appears to be the boys who dominate in these fields in the German speaking areas. These variations somehow indicates to us the complexity of the gender issue, in which there ought to exist important variations of practicing gender between the cultures and nations, and which gives us some indications of the heterogeneity of the NMLs.

In spite of this growing activity and advanced use of digital resources by both boys and girls at home, until now there have not been many attempts to introduce any of these web resources and adjust them within a pedagogical framework at school.

In the Scandinavian countries there have been some attempts; for instance, both weblogging and wikipedia have to some extent been used in upper secondary education in Norway, but so far there exists little research connected to these attempts. Works by Lund and Lund, Rasmussen and Smørðal) report how WIKI technologies shape tensions between individual and collective practice in the classroom (A. Lund, 2006; A. Lund, Rasmussen, I. & O. Smørðal, 2007). It has to be mentioned that none of these small scale studies include gender perspectives. Also in the German speaking areas there have been some attempts to include wikis and weblogs, but mostly in higher education.

b. Boys and girls and gaming

There is evidence that the boys dominate and show their preference towards gaming activities, both at home and at school. PISA 2006 confirms this, as well as EU surveys and national surveys from the OECD countries (Arnseth, 2007; OECD, 2007; Smihily, 2007). This interest in gaming appears to be most apparent with young boys, and there is a shift of interest as the boys grow older, in terms of a stronger focus on the use of ICT for educational purposes (Kent & Facer, 2004).

What is striking is that the young girls also appear to have an interest in gaming, not to the same extent as the boys, but still, they play (Smihily, 2007). Carr and Pelletier shows in a study conducted in schools in the UK that girls do play, but they do not talk about games by using the term 'gaming', instead they talk about the games by using their titles, like 'the Sims' (Carr, 2005). The study shows how both boys and girls consider gaming as a male activity, in which the girls don't want to be associated. Also the German speaking countries report that there exists a gender difference in the interest in the types of games; whereas boys show their preference in sport and action games, girls appear to be more interested in social games, in fun, in jump-and-run-games (Todorova et al., 2008).

Another important issue is to stress the stereotypical portrayals of women and minorities in videogames and the impact these characterizations might have on youngsters (Brenick, 2007). Research does show us that there is a positive association between violent gameplay and anti-women attitudes including support violence against women (Dill, 2005) and that women are under-represented, stereotyped and objectified in videogames (Burgess, (in press)).

As for the educational use of gaming, so far there is no clear effect established in academic learning (Egenfeldt-Nielsen, 2006). Still, there is evidence that games contribute to improving general skills, such as collaboration skills, perceptual and motor learning, ICT skills, and higher order thinking skills; like problem-solving and strategic thinking (Kirriemuir, 2004).

There is some evidence indicating that the use of games in a pedagogical setting improves boys' attitudes and motivation towards education (Egenfeldt-Nielsen, 2006; Kirriemuir, 2004). On the other hand, the use of games for school related purposes does not motivate the girls with high scores, on the contrary (Kirriemuir, 2004).

There is still some lack of knowledge on how games influence learning and learning outcome. Although there have been some attempts to introduce particular games for educational purposes (entitled serious games/epistemic games), we do not know yet to which degree they will succeed, and more important in this case, we do not know if they will manage to engage the girls or even the boys. Moreover as shown above, researchers do stress the importance of differentiating between video games contents related to gender stereotypes and to gender-specific motivations and there is a need for more research in order to elaborate on necessary guidelines for further research as well as policymaking on the issue.

4. Conclusions: challenging our views of stereotypes

As shown in this paper, there is empirical evidence to suggest that there do exist differences between the boys and girls and their attitudes, preferences and use of ICT, both at school and

elsewhere. Moreover, there is also empirical evidence that indicates that the boys spend more time with computers and play more computer games than girls. It has also been shown that in several of the OECD countries and elsewhere, the field of gender, ICT and education has been dominated by the idea that boys use of and attitudes towards ICT is considered the norm.

Back in 2003, Corneliussen identified three dominating discourses that had influenced the field of gender and ICT in Norway; those were 1) a gender blind discourse; in which gender were not considered as an issue at all, 2) a masculine discourse, in which the relation between men and technology were considered as very strong, and 3) a feminine discourse; meaning that one could identify a turn towards femininity, but nevertheless, without challenging the strong connection between men, masculinity and technology (Corneliussen, 2003). These discourses are also to some extent reflected in other OECD countries, where they are influenced by different cultural contexts.

In 2008 it is about time to continue challenging this connection, and to see what the alternatives are. A first possible step is to understand more about boys' and girls' performance, attitudes and use of different ICT(s)³; both at school and elsewhere. As briefly introduced, there is evidence that there are differences between the genders when it comes to this, and it is possible to frame this in a claim that boys are gamers and girls are communicators. This stereotypification of boys and girls might be useful in different ways. First, it gives an opening to question the stereotypes themselves, it helps us to understand more about youth culture, and it might even be useful in our way to frame and conceptualize possible steps in policymaking as well as challenges for future research.

The claim of stereotypes is in other words faced by some striking challenges, and some of those can be summed up as follows:

- 1) The reality is more complex than the picture given by the stereotyped view of boys and girls; for example do we know that girls are also playing computergames, they are high performers in social networks and other web 2.0 activities. In addition, not all boys play computer games and some of them are even more interested in the internet in general.
- 2) Youth culture is in itself gender oriented, young people use digital media as a tool to position themselves as gendered subjects and this is an important part of shaping of identity. Massmedia, parents, peers and even schools might contribute to confirm this development.
- 3) Language use appears also to be gendered when it comes to ICT; boys and girls talk about ICT differently, even if their computer skills are equal. This might be interpreted as a part of their socialization process and is strongly related to their positioning as gendered subjects.
- 4) Youth culture is a gendered culture and the language is also connected with how

³ ICT is used in plurals (ICTs) to indicate that this term include more digital devices and mediums that just computers. Most of the time it would be the computers that are being referred to, and when other devices are included in the term, like cell phones, handhelds and even iPods, this would be highlighted.

young people would like to be identified as males and females, and this is an important challenge for research.

- 5) How can it be possible to be able to frame this gender diversity concerning ICT in research? One possible approach might be to include several methods, both quantitative and qualitative, since we do know that boys and girls show different preferences towards devices, tools and media. Their user patterns are also highly interesting in order to nuance the picture. For example does the PISA 2006 questionnaire include the use of videogames, but not participation in social network?

5. Policy implications and policy practice recommendations

A central aspect in the NML-project has been to ask if there is a kind of homogeneity when it comes to gender within the NML-generation in all of the OECD member countries, or, if we can find any country specific variations. Western countries, not necessarily Asia and elsewhere, have, to a large extent, based the development of policymaking on the assumption that the girls are falling behind the boys in the field of ICT, both in schools, in higher education and as professionals. Gansmo makes an interesting point when she claims that the Norwegian policymaking appears to have 'looked into dualisms' thinking that boys do this and girls do that. She claims that it is time to stop thinking in dichotomies and stereotyped understandings of genders (Gansmo, 2004). This point of view is also supported by Lagesen, who in a field study of ICT students in Norway and Malaysia found that in Malaysia computing studies at some universities is dominated by girls, which is in strong contrast to the situation in Norway. She explains this from the fact that the two countries have different perspectives on the study, girls in Malaysia see the possibilities in computer technology as a career and they are supported by parents and family (Lagesen, 2008).

Research findings presented in this paper identify some challenges and also offer some guidelines for future policymaking in the educational field concerning gender and ICT. Among the most important are the following:

1. While this paper has had its main focus on gender and technology in education, we do know that there is a gender imbalance in many fields in society. We also know that technology might be a driver to obtain more gender equity in society as such. ICT is to be considered as both *a tool* and *a goal* in this process.
 - a. It is therefore a challenge both for education and for the research community to find ways to stress the relevance of a more gender-balanced field of ICT.
 - b. Educational policies should also explore how ICT can be better targeted in order to address gender-specific challenges, for example in which ways can ICT be used to improve the performance of male learners.
2. Educational policies should raise awareness in teachers and even parents consciousness on how to broaden the view on thinking of gender and ICT, in order to prevent to reinforcing stereotyped views on gender and ICT. Policy practices

suggestions are:

- a. Development of a set of guidelines for teachers and parents based on what research says regarding the complex picture of gender and ICT on attitudes, preferences and performances.
 - b. Train teachers on how to approach boys' and girls' different ways of attitudes, performance and talk about ICT, in order to include everyone.
3. Educational policies should promote more systematic research in order to grasp young peoples performances in Web 2.0 activities with a certain focus on gender. Recommended practices are:
- a. Creation of incentives to promote systematic studies on the use of different web 2.0 applications as well as videogames in the classroom and their effect on new generations on learning. A certain focus on gender is to be included. This should be done at a national and an international level, in order to have comparable data.
 - b. Creation on incentives to promote systematic studies on digital assessment and in which ways this might relate to gender. Also this should be done at a national and an international level, in order to have comparable data.
 - c. Conduct studies which ought to include several methods, both quantitative and qualitative, in order to grasp the diversity of preferences and uses of devices, tools and media.
4. Finally, educational policies should consider to relating more strongly to other governmental bodies who work with the gender issue, in order to incorporate the gender and ICT issues in a broader sense, like in the workplace, in lifelong learning perspectives and so on.

Results for the survey which were conducted as a preparation for the OECD Expert meeting on the issue⁴, show that this issue had not been highlighted in former policy plans in the OECD countries.

⁴ Please note that not all countries did respond on the survey.

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