ITALIAN JOURNAL OF SOCIOLOGY OF EDUCATION
Editor-in-Chief: Silvio Scanagatta | ISSN 2035-4983

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Article first published online

June 2016

HOW TO CITE

Casula, C., & De Feo, A. (2016). Education 2.0 and Gender: A Case Study on the Use of Interactive Whiteboards in Secondary Schools. *Italian Journal of Sociology of Education*, *8*(2), 143-169. doi: 10.14658/pupj-ijse-2016-2-7

PADOVA UNIVERSITY PRESS

Education 2.0 and Gender: A Case Study on the Use of Interactive Whiteboards in Secondary Schools

Clementina Casula[*] *and Antonietta De Feo*[**]

Abstract: The digitalization of education systems is presented as a possible way to match the concerns of a knowledge based economy with those of an inclusive information society. To meet this double challenge, education systems are asked to shift from a 'traditional school' to an 'Education 2.0' model, introducing innovative pedagogies through the use of ICT devices characterized by interactivity and multimediality. The article investigates over the presence and breadth of this shift within secondary schools of the region Sardinia, Italy, since the introduction of Interactive Whiteboards (IWB), to focus next on the gender dimension of change. Empirical evidence drawn from an evaluative research adopting a mixed method approach is presented and analysed: first, an idealtype of classroom organization after IWB introduction is offered, then the main gender dynamics emerging in reorganized classrooms are considered, focussing on interaction among its main actors', namely teachers and students. Conclusions suggest that, although a less gendered approach to technology is observed in classroom practices enhanced by Education 2.0 models, these changes haven't (yet) led to a reconfiguration of the symbolic representations and tacit assumptions structuring school settings, still hampering fairer educational and professional trajectories for women in STEM (Science, Technology, Engineering, Maths).

Keywords: education 2.0, gender and technology, interactive whiteboards (IWB), educational and professional segregation

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Introduction. The double challenge of the digital revolution to education systems

Information and Communication Technologies (ICT) represent one of the crucial policy sectors where governments, influenced by intergovernmental organizations and institutions[1], are asked to invest to respond to the challenges of a globalized world economy. Digital agendas, although often focused on infrastructural measures, are inserted within a wider discourse presenting the 'digital revolution' as a window of opportunity for democratic societies to find more efficient, accountable and participatory institutional equilibria[2]. From this view, the digitalization of schools (and, more in general, of education systems) is presented as a possible way to match the concerns of a knowledge based economy with those of an inclusive information society. To meet this double challenge, education systems are asked to shift from a 'traditional school' model, as typically defined within welfare regimes of modern industrial societies, to 'Education 2.0' ones, introducing innovative pedagogies through the use of ICT devices characterized by interactivity and multimediality (Calidoni & Casula, 2015). Traditional school models are in fact increasingly judged as obsolete and inadequate to respond to the needs of contemporary economies and as still embodying mechanisms of reproduction and cultural legitimization of social inequality (Bourdieu & Passeron, 1970; Bernstein, 1971, Collins, 1979; Schizzerotto & Barone, 2006; Ballarino & Checchi, 2006). The network logic of Education 2.0 models, conversely, is believed to enhance the de-structuring of hierarchical forms of interaction, bridging learning gaps of different social actors and meeting the demands for cooperative learning environments and flexible, tailor-made educational programs, raised by contemporary labour markets and innovative pedagogic approaches (Castells, 2001; Ingrosso & Spaggiari, 2006; Tagliagambe, 2010).

The emergence of Education 2.0 models out of the digitalization of schools remains, however, a controversial matter. Despite the widespread agreement over the fact that there is value in the application of some innovative technology to learning (Winzenried *et al*., 2010), critical voices

[1] IMF, OECD, UN, WB (2000), OECD (2010), Derouet, 2012.

[2] One of the seven pillars of the Europe 2020 Strategy, defining the objectives for the growth of the European Union (EU) by 2020, is the *Digital Agenda*, encouraging Member States to exploit the potential of ICT to foster innovation, economic growth and progress. For a discussion on EU's search for leadership within a globalised knowledge economy, see Casula (2009).

have questioned the reasons behind large scale investments undertaken in the sector, especially in a period of reduced resources for education systems (Cuban, 2001; Somekh, 2004). Briefly, the issue asks for further empirical investigation that, equipped with adequate multidimensional tools (Pandolfini, 2015), may allow to investigate the complex role of technology in education systems. Recently, an interesting body of literature has developed over the effects of the introduction in schools of Interactive Whiteboards (IWB), digital devices composed by a computer, a data projector and a large white screen, touch-sensitive in their latest versions (Winzenried et al., 2010). The potential of those devices in enhancing Education 2.0 models is related to their versatility and user-friendly features, favouring the integration of various media, collective learning and collaborative interaction (Lee & Winzenried, 2009).

The present article contributes to this discussion considering if and how the introduction of IWB enhances the adoption of Education 2.0 models and, if so, in what ways this educational shift challenges the traditional male bias in the definition of technology. The bias, in fact, appears as still being supported by modern school systems, formally oriented to equal opportunities and meritocracy, but practically reiterating socialisation processes of gender differentiation (Acker, 1994; Skelton, 1993; Abbott *et al.*, 2005). Empirical evidence will be drawn from an evaluative research based on a mixed method approach on the implementation of the *Sardinia Digital School* (SDS) project, foreseeing the provision of a IWB for each classroom of all the schools within the Italian island region and specific training programs to instruct all teachers on their use. After having addressed some of the core arguments of the literature on gender divides in technology and education, the article draws on research results, focussing on the case of secondary schools of the Cagliari province to present an idealtype of classroom organization after IWB introduction, where to set the analysis of the main gender dynamics emerging, respectively, among teachers and among students, both interacting within changed learning environments.

Gender divides in education and technology

The role played by education systems of post-war welfare regimes in tackling gender divides is somehow paradoxical (Reay, 2002): on the one hand the formal recognition of the concept of equality of educational opportunity gradually lead to the feminization of studies, disclosing women

new personal and professional horizons (Saraceno, 1992; Reyneri & Scherer, 2008); on the other hand the subtle influence of gendered practices incorporated in traditional education models, reinforces gender stereotypes naturalizing forms of masculine dominion (Bourdieu, 1998; Barone, 2011). Despite significant participation of women to education systems, their choices are still rarely oriented to STEM disciplines (including Science, Technology, Engineering, Mathematics), often leading to most rewarding jobs (OECD, 2015).

Studies on the persistent segregation of women in education have disclosed the gendered nature of traditional school models, hidden behind universalistic rules and standardized programs: from teachers' different expectations and attitudes towards boys and girls, to textbooks' stereotyped representations of gender identities, to the vertical segregation of school systems, where most management position within a strongly feminized professional field are held by men (Lindroos, 1995; Wolpe, 1988; Skelton, 1993, Abrahams, 1995; Burgess, 1990). In the 'hidden curriculum' of the traditional school model, science and technology are masculine subjects: this basic rule, more or less consciously reinforced by teachers, peers and parents (Kelly, 1982; Gold, 1990; Wajcman, 1991; Acker, 1994; Skelton, 2002), affects girls' gender identity and carvels their self-confidence. School girls generally report lower results than boys in scientific subjects and reveal stronger anxiety feelings associated to those disciplines, resulting in a significant decrease of their performance (OECD, 2015, pp. 32-157). These negative experiences at school ultimately influence girls' later choices: even when formal actions are taken to encourage their participation in the STEM area, either in education or vocational training, they largely end up opting for curricula within humanities, social sciences, nursing, arts and crafts or family care sectors (Kelly, 1987; Warrington & Younger, 2000), better fit to meet future domestic responsibilities, increasingly seen as compatible with a working life often dwelt in lower-paid and lower-status jobs (Sharpe, 1995).

The gendered nature of traditional educational models also influences the relation between women and ICT. In the 1980s, with the diffusion of personal computers in schools, informatics is introduced as a subject soon seized by men, given both its connection with the STEM area and its historical development as a cultural artefact strongly associated to masculine practices and identity[3]. The development of statistics and studies

[3] See Cockburn, 1983; Webster, 1989; Wajcman, 1991; Clegg, 2001. Some of the early computers were developed within the military sectors, as traceable in the language still used

on digital divides showed that women often had lower chances than men to access a computer or the internet and that, when gaps tended to close, their use was less frequent or competent (DiMaggio et al., 2003; Sartori, 2006). These general trends, however, require more case specific analysis to account for the complexity of the issue. In the Italian case, considered in this article, official statistics shows the persistence of a gender digital divide, favouring men both in terms of greater access to the computer and the internet and higher levels of competence in ICT use, especially for computer skills (Istat, 2009, 2014). However, the gender digital divide is not present for young Italians in school age, representing the largest part of ICT users, for whom distance in competences are smaller and slightly higher for girls in the case of skills linked to communication activities[4]. Italian girls also access to the internet through mobile digital devices more than boys and are more active in seizing the various activities they offer (as participation to social networks) (Istat, 2014).

The latter considerations suggest that the increasing use, as favoured gateways to access the internet, of mobile phones - finding extensive diffusion among women[5] - as well as other multimedia devices, asks for a reconceptualization of the digital divide debate, originally focused on the computer as the exclusive device to access the internet (Broadbent, 2012). As argued elsewhere by the authors (Casula & Mongili, 2006; Casula & De Feo, 2015), widening the borders of the debate on digital divides, to include access and use of other 2.0 devices, might have significant effects in the study of gender and technology relations: for instance, it would allow to avoid the conceptual bias overestimating masculine digital competence linked to computer technology, while underrating feminine competence with mobile devices and social applications. Following this argument, the introduction of IWB in schools seems to offer an ideal case to study gender and technology relations within a reframed conception of the digital divide debate: in fact, the IWB represents a new technological device that, in principle, may not automatically conform to previous gender differentiation

for some of the main keyboard commands ('Control', 'Alt', 'Delete'). Literature has shown how the videogame industry was developed defining war or competitive games, leading to an increased interest of boys for computer science classes (see, among others, Wajcman, 1991; Goode et al., 2006).

[4] It is perhaps worth noticing that competence is measured on the basis of a self-evaluation of interviewees, where different levels of self-esteem in areas with a strong gender definition may play a not secondary role (see Casula & Mongili, 2006).

[5] On the relation between women and the telephone, as a technological device, see Fisher, 1988; Frissen, 1995; Castells, 2001; Wajcman et al., 2009.

(Wajcman, 1991, p. 151) and that unites both computer and mobile devices 'touchscreen' logic, thus allowing for a possible integration of masculine and feminine technological cultures.

The research: the gender dimension of the *Sardinia Digital School* project

It has been argued that IWB may have a significant impact in education only when it becomes part of the regular pattern of classroom interaction (Greiffenhagen, 2004; Glover & Miller, 2001). This was the case in the project studied by the research, *Semid@s: Sardinia Digital School* (SDS), officially launched in 2009 by the Sardinian regional government with ambitious objectives and a significant budget[6]. Policy creators had originally devised the project with the aim to promote, through a systematic technological innovation of the regional school system, a didactical approach that represents a prototype of Education 2.0 models: its main aim was to 'reverse' the traditional school logic, through the promotion of cooperation and interaction among teachers and students, actively involved in the process of knowledge creation and sharing[7].

The policy was defined in order to foresee a series of interrelated measures of different nature, aimed at boosting the envisaged change: the provision of a complete IWB set for each classroom and of free loan tablets for all teachers and students; the construction or improvement of the broadband internet network; the delivery of training actions for IWB use gradually involving all teachers; the encouragement of cooperation practices among teachers and students for the production and sharing of digital knowledge. The project evaluation was assigned by the Region Sardinia, through a call for tender, to the Centre for Research in Education and Culture (CIRD) of the Universities of Cagliari and Sassari. The authors were part of the CIRD multidisciplinary team, which adopted a mixed method approach, integrating quantitative and qualitative tools, and involved school actors within the evaluative process, intended as collective learning endeavour aiming to improve the policy cycle (De Feo & Pitzalis, 2014).

[6] The SDS project was officially launched by a deliberation of the regional Council (n. 52/9, dated 27.11.2009), with a provision of a total budget of nearly 120 billion Euros (49% from the European Regional Development Fund and 51% from the European Social Fund).

[7] Among the main policy creators, Silvano Tagliagambe (university professor in Epistemology) and Luciano Pes (high school teacher in Philosophy).

At the time of defining operationally the measures to be implemented, however, bureaucratic rigidities and political disagreements registered both at the national and regional level led the project to experience severe delays and reformulations. It is only in 2013, four years after its official launching, that the SDS project became concretely operational, with obviously strongly reduced chances to meet its original aims within the foreseen period. CIRD's evaluative research followed the measures realised until 2015, namely the introduction of IWBs within classrooms and a first phase of the teacher training actions[8].

Research tools have included: a preliminary mapping of the state of technological innovations in the regional school system; the identification of the institutes where to realise in-depth analysis on upper secondary schools; interviews with school managers and teachers; focus groups with students; direct observation during IWB use in the classroom. On the basis of the collected information a questionnaire on IWB use was submitted to a random sample of teachers of the regional school system.

Throughout the research, the authors of this article have particularly focused on the gender dimension, within the wider picture of envisaged technological change.

Although, the research design defines technological innovation as its independent variable and classroom organization as its dependent one, this distinction merely serves analytical purposes: the theoretical approach adopted, in fact, avoids techno-deterministic positions, while recognising the existence of a mutual, complex and dynamic relation between gender and technology (Stepulevage, 2001; Wajcman, 2007), which needs to be explored in depth through empirical research.

In the next paragraphs, the main results of analysis are presented with reference to ethnographic observations[9], focus groups[10] and interviews[11] realised in secondary schools located within the province of Cagliari.

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[8] The SDS project foresaw training courses for teachers on IBW use following a 'cascade' mechanism articulated in three phases: the first one instructing SDS tutors; the second one seeing SDS tutors preparing 1000 school teachers with a higher level of technological expertise (the so-called Master Teachers); the third one, still in progress, where Master Teachers' train all other teachers of the regional school system (Ghiaccio, 2015).

[9] More than 50 observation were realized (between January and May 2014) in a third year scientific lyceum class during Maths, English and History lessons and a third and fifth year professional institute classes during Maths, History of Arts and Geography lessons. The precompiled Excel grid used by two researchers to record classroom dynamics was enriched by descriptive notes on interactions.

[10] Eight focus groups with students were organised in secondary schools within the province of Cagliari, the most populated of the region Sardinia, to cover the main types of institutes:

The argument develops following three main steps: first, classroom organization after IWB introduction is considered, interpreting observed differences through an idealtype including three classroom models; gender dynamics emerging within reorganized classrooms is thus analysed, focussing on each of the two main categories of human actors involved in the process of innovation, namely teachers and students.

The classroom

As said, a central measure of SDS project was the dotation of a IWB for each single class of the regional school system of Sardinia.

This meant that the new technological device, rather than being confined in computer labs or other settings specifically reserved to ICT use, was inserted in each classroom, to become part of its daily landscape and practices. Drawing on the literature on socio-materiality of classroom practices (Fele & Paoletti 2003; Roehl 2012), the analysis considered classrooms as socially organized fields of interaction, in a before/after comparison since IWB introduction.

From the adopted view, teachers, students and the IWB itself, represent crucial actors involved in the social process of innovation within the classroom (Fenwik & Edwards, 2013), considered as main unit of the organizational analysis. As a technological device, the IWB allows the connection of both material and human actors, creating a specific social order (Callon, *et al.*, 2007; Vitteritti, 2014); this order, at the same time, is influenced by human actors' dispositions and resources[12]. In this regard, it is relevant to notice that the introduction of the IWB within the national and regional school system was accompanied by wide expectations for change, not only in terms of technical devices used, but - chiefly - of

lyceums (usually leading to the tertiary level of education) and professional institutes (offering vocational training); to take into account the gender dimension of vocational training, professional institutes have included technical as well as pedagogic institutes (seeing a higher participation of, respectively, boys and girls). The average number of participant was of 10 for each focus group, for a total of nearly 80 students between 15-21 years of age.

[11] Nearly 20 in-depth interviews with teachers were realized between February 2013 and June 2014, discussing issues ranging from professional trajectories to pedagogical approach, experience with the use of IWB in the classroom and opinions on ICT potential for teaching. Interviewees were selected within the institutes participating to the research, trying to cover different disciplinary areas.

[12] The reference here goes to Bourdieu's considerations on *habitus* and on the different kinds of capitals (economic, cultural, social) that individuals can retrieve for action within a given field (Bourdieu, 1998, 2010).

didactical methods adopted; IWB introduction, therefore, paved the way to the legitimisation of a wider project of innovation within a chiefly conservative school system, towards models already legitimised within pedagogical debates, but still marginal in the rules and hierarchies organizing didactical praxis (Pitzalis & De Feo, 2016).

In considering the main changes produced by IWB introduction, the analysis focused on two crucial dimensions of change: classrooms' spatial distribution (and thus variation from centralised to networked structures), and the kind of interaction taking place among classroom's actors (ranging from hierarchical to egalitarian relations) (in figure 1 those dimension are respectively represented with a blue and a red dotted line).

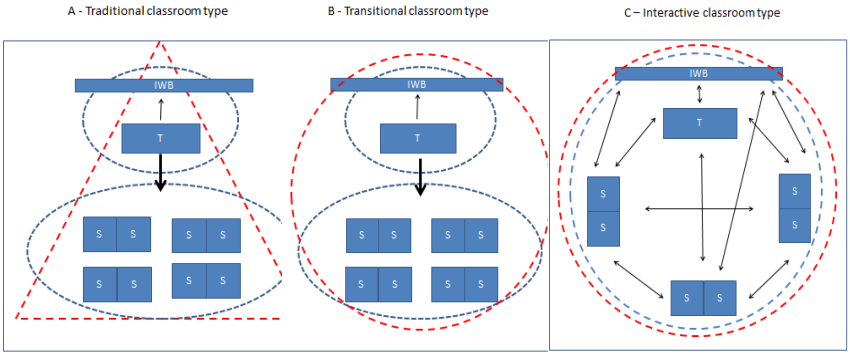
Before IWB introduction, classrooms generally presented the typical organization of traditional school models, spatially embodying the rules of frontal teaching, hierarchy, discipline and centralised control.

Classrooms were thus usually divided in two areas, set in a mirror disposition consenting to pay, respectively, attention and control to each other: one area was designed for students (each seated in equally aligned rows of double desks), the second area was reserved to the teacher (with a larger desk, often on a stage, symbolically reminding authority and practically favouring class supervision).

After IWB introduction, the situation became more differentiated, largely varying according to teachers' openness to technological and didactical change; in figure 1, the variety of learning environments observed is idealtypically reported to three main classroom types, defined by a combination of the two considered dimensions of change.

In the 'traditional classroom' type (figure 1, type A) the new device is either ignored or adapted to the traditional school model, with the IWB inserted - as the 'old blackboard' - within the sphere of action of the teacher, who holds a gatekeeper role between legitimate knowledge and students, following a one-way communication flux and a hierarchical structure. This first classroom type was mostly found in the initial phase of the project, mainly in the case of teachers with little or no previous practice with ICT, often senior staff of the humanities area.

Figure 1. Spatial organization and social interaction of classrooms after IWB introduction



Deviation from the traditional school model is here also minimal or absent in terms of teacher-students interaction, as it emerges in the dialogue from a focus group reported below.

> FG4 - Lyceum
> David: For instance, we haven't tried the use of the IWB with Latin. I would like to check a version at the whiteboard after the quiz, but our Latin teacher, she's anti-technological! So it would be better to organize courses for teachers….
> Diana: They already did that, but ….
> Moderator: So you feel that there are some teachers who aren't quite convinced of IWB's usefulness?
> Diana: Let's rather say that they know that they are unable [to use it]. Even with the computer they don't have a good relation. They prefer to sit at their desk, reading and explaining from there, rather than staying among us and explaining us directly…

In type A classroom the IWB is kept by teachers – fearing the conversion of their lack of technological expertise to a lack of authority - within their area of control, where students' access is strongly limited and allowed only under strict supervision. IWB use is restrained during lessons and forbidden during recreation time, reducing students' opportunities to manipulate the new device, after teachers' argument that they are held responsible for eventual damages. Teachers' control over students' access to technology sometimes extends to their personal devices (with

smartphones and tablets banned from classroom), preventing claims based on students' greater technological expertise and frustrating their aspirations to contribute to the learning process with skills developed outside the classroom.

In the 'transitional type' of classroom (figure 1, type B) spatial distribution remains as in the traditional one, but teacher-students relations shift from a hierarchical and directive to a more cooperative and egalitarian interaction, oriented to the achievement of a common goal[13]. In this kind of classroom, even when IWB use is not particularly advanced, teachers make the most of the possibilities offered by the new device at the relational level, paving the way to a change from interactive technology towards interactive pedagogy (Beauchamp & Kennewell, 2010). The gradual adoption by teachers of the logic and culture of Education 2.0 models leads to the fall of the invisible walls separating them from the students, changing their role from that of 'the sage on the stage' to that of 'the guide on the side' (McNair, 2000, p. 15). As nicely outlined by a lyceum students in the quote reported below, this new, closer relation created between students and teachers through IWB use, positively influences the effectiveness of the learning process.

> FG4-Lyceum
> Douglas: Also, the fact that the oral test is not of the kind: "Come to my desk!", which is a sort of barrier between us and them, while with the IWB you are much more near in the relation. [It is] very different and much more stimulating!

Finally, a third type of classroom was identified (fig.1, type C), where the cooperative relation between teachers and students seen in type B coincides with a spatial reconfiguration of the classroom according to a networked structure embodying a more egalitarian logic facilitating communication and cooperation between actors involved. The occurrence of this type of classroom was more rare and usually linked to the presence among the staff of influent teachers, that may be defined as 'educational entrepreneurs', promoting within their school the adoption of new

[13] An example of this type is offered by a classroom of a professional institute where teachers successfully involved students (mainly girls, often repeating the year after failing) in a process of gradual discovery of the IWB software, starting with basic steps (like the choice of font and colour in writing), to progress towards more complex activities (as the creation of conceptual maps), following a logic of shared knowledge (from the creation of folders shared via email, to the integration of individual work within common platforms).

pedagogical approaches oriented toward greater cooperation and exchange among all kinds of school actors (colleagues, small groups of students, classroom) involved in a common process of mutual learning as well as knowledge creation. Often – but not always - already passionate ICT users before IWB introduction, those teachers usually favour the integration in the classroom of various ICT devices that students mostly used outside school, first of all smartphones[14], as part of their wider project of enhancing the adoption of pedagogical approaches well-fitting within Education 2.0 models[15].

The teachers

A crucial key to the success of any process of innovation introduced within learning systems is the propensity of educators to innovate, ultimately linked to their professional experience and the cultural, organizational and institutional features of their working environment[16]. Literature on IWB introduction also outlines the influence of teachers' attitude to technology in the impact of pedagogic change triggered by technological innovation (Glover & Miller, 2001; McCormick & Scrimshaw, 2001). In our research, a questionnaire defining a synthetic indicator of Propensity to Innovative Digital Teaching (PIDT) was provided[17], measuring teachers' stance on innovating their pedagogical

[14] Among the activities promoted within one of those classes, the generation and decoding, through the use of students' smartphones, of QR codes on the authors studied during the course.

[15] Often teachers of philosophical or pedagogical subjects, they mainly conceive the use of ICT in the classroom as a means to promote innovation in education and learning. This point distinguishes the logic motivating our 'educational entrepreneurs' from that of the 'missionaries' described by Glover & Miller (2001, p. 272), given that the latter are primarily moved by the "intent on securing a following for the technology based upon their own enthusiasm and obvious technical skills and with a readiness to embrace interactive learning styles".

[16] "In our type of economy and society the key quality of the labour force depends on its education, and the labour forces' education depends on the educators (…) even if we build schools, even with laptops for every child – if there are no good teachers, there can be no good education. And that requires all kind of things including the working conditions for the teachers" (Castells, 2009).

[17] Items considered by the questionnaire were defined considering the Teaching and Learning International Survey (TALIS) 2008 data (Vieluf et al., 2012) and other research on this topic (among other, Frank et al., 2004; Wu et al., 2007). For further details on the rationale behind the choice of the statistical model adopted for the survey (*Item Response Theory*), see Giambona *et al.* (2015).

practices through the use of digital technologies. Survey analysis identified a series of factors significantly related to PIDT: a strong sense of belonging to the school community and high participation rates to its cooperative activities; the involvement in training courses on ICT use; the taking of institutional responsibility on ICT management; a frequent personal use of ICT. As for the gender dimension, the analysis reveals an indirect (or mediated) effect on the PIDT indicator: in the selected teachers sample, men register higher rates of personal use of ICT, while women show a higher sense of belonging to the school community (Giambona *et al*., 2015).

The higher sense of belonging displayed by female teachers seems to be in line with their greater involvement in institutional responsibilities: in table 1, we can see how the percentage of teachers having an institutional responsibility among females is more than double than among males (32% against 15%); however, in the case of institutional responsibilities concerning the ICT sector the picture is reversed and registers higher percentages among male than among female teachers (39% against 19%).

Where the 'gender habitus' (Bourdieu, 1998) does not seem to play a major role is within the subcategory of maths teachers (if not for a more frequent feminine fear that a too extensive IWB reduces autonomous reasoning abilities). Although it has been argued that "ability in mathematics is not an indication of aptitude for computing" (Wajcman, 1991, p. 152; Hoyles, 1988), male and female teachers belonging to this discipline appear to be legitimised both at the formal and informal level as experts within the ICT field.

Since the 1980s national training programmes have increasingly integrated ICT teaching within the maths curriculum[18] and both teachers and students interviewed seem to share the view that maths is a basic prerequisite to access computer knowledge and to handle with competence digital devices.

A more clear gender differentiation dynamic in teachers' relation with technology emerges in the case of teachers of the humanities area, less familiar with the use of ICT - especially if advanced in age - and unwilling to show their technological inability in front of students belonging to the 'digital natives' generation.

[18] The reference is to the *Piano Nazionale Informatica*, a national plan developed between 1985 and 1986 by the Italian Ministry of Education in order to respond to the introduction of computer technology within education systems promoted by the EU. The Plan foresaw the use of personal computers in math and physics classes for the first two years of secondary school.

Table 1. Institutional responsibilities of Sardinian school teachers, per gender (%)

	Teachers	
	Female (%)	Male (%)
With institutional responsibility on ICT sector	18,55	38,81
With institutional responsibility on other sectors	32,00	14,93
Without institutional responsibility	49,45	46,27
Total	100,00	100,00

Source: CIRD, Survey for the evaluation of the SDS project.

In the case of women, the uneasiness with the introduction of the IWB was often accompanied by emotions such as fear and anxiety, more rarely noticed in their male colleagues, both of the same area or of the scientific one (as reported in the quote below from the interview with a male maths teacher).

> Teacher: It's clear that technology scares a little, isn't it? I've noticed that in several of my female colleagues: at the beginning they were scared: "But I, that thing, I don't know how to use it! How do I do?"…
> Researcher: Why do you refer to your female colleagues, rather than to your colleagues in general?
> Teacher: Well, I say female colleagues because the majority of teachers in the Italian school are women. However, I have to say that at the beginning [when the IWB was introduced] it was more rare to find [male] colleagues having the same fears. Well, anyway it's a difficult comparison because eight over ten teachers are women, therefore… It's also a question of discipline: those of humanities [are more scared] and us of science and maths a little less…

To overcome feelings of inadequateness, magnified by a gender identity built in accordance with cultural schemes defining technology as a masculine dominion (Casula & Mongili, 2006), female teachers of the humanities area react either recovering in the 'traditional type' of classroom model (figure 1, type A) or, on the contrary, attending all training initiatives organized by their school or the Region on IWB, seen as an opportunity to update their skills and innovate their didactical approach (gradually shifting their classrooms from an A to a B type).

The fact that male humanities teachers do not seem to share the struggles experienced by their female colleagues after IWB introduction can be reported to a mix of cultural and structural reasons. As confirmed by a female lyceum teacher in the quote below, the hurdles of finding a work-life balance are usually amplified for women by the gender asymmetry in

the division of domestic labour[19], ultimately disadvantaging working women *vis à vis* their male colleagues in terms of accumulation of skills and expertise, cultivated in the private sphere, but convertible into the professional one.

> Teacher: It's not the lack of interest [for ICT], absolutely not, but it rather is a work-life balance problem: I have three children and it's therefore very difficult to find time for other activities.

An interesting case challenging traditional gender-technology categories was offered to the research by English Language Teachers (ELT). The teaching of foreign languages, ascribable to the humanities areas and hence strongly feminized (Tamanini, 2007), over the last decades has considerably changed the tools and logic of its didactics, shifting from teacher-centred to learner-centred approaches, while following the evolution of technological devices as fundamental support to education (from tape recorders, to VHS, to e-learning platforms) (Cutrim Schmid & Whyte, 2012; Salehi & Salehi, 2012). ELT were therefore already accustomed to adapt to frequent technology innovations and to a more cooperative and less structured learning process: their shift towards the integration of IWB in teaching and the adoption of an interactive teacher-student approach (defined in type C, fig.1) was thus "smooth", as in the following quote.

> Teacher: I teach English and since many years I move within multimediality out of necessity. I always took the tape recorder with me, to make student listen to conversations in English; then I used to project the slides, especially when I had to present some particular structure [of sentences] (…) So, it's clear that with the IWB I was in my element!

Although ELT (as said, prevalently women) are recognised as expert users of IWB both by colleagues and students, they are rarely assigned institutional responsibilities for ICT management (as seen, mostly held by men). This fact might be related to the presence of an implicit mechanism of hierarchical distinction between different types of technological mastery. The 'hard' mastery, linked to computing practices traditionally associated

[19] The unequal distribution of leisure time within households is also experienced by girls (Wajcman, 1991, p.154), but mainly concerns adults women, especially in countries such as Italy, where domestic work is particularly 'ill divided' among genders (Saraceno, 1980; Casula, 2006; Istat, 2010).

to manliness (as programming or manipulation of hardware drives) and 'soft' mastery linked to computing practices seen as more appropriate to feminine personalities (as power point presentations or social networks) (Turckle, 1984; Turckle & Papert, 1992). Leaving aside arguments against a distinction recalling essentialist presumptions on sexual difference, rather than uncovering their historical formation (Wajcman, 1991, p.157), the point here is that legitimate technological mastery at school seems to coincide with the one stereotypically associated to masculine culture and identity (Stepulevage, 2001; Abbiss, 2011), although the hybrid nature of the IWB and other ICT 2.0 devices would allow the integration of the two kinds of expertise and cultures.

The students

Overall, the students have welcomed the introduction in their classroom of the IWB, that they consider as a device at pace with the technological innovations experienced through the extensive use of ICT 2.0 in their daily life. Their positive assessment of the IWB is often based on the technical features of the device, which allows to speed up communication and information processes and ultimately to make the learning process "*easier*", "*coloured*", "*more interesting*", "*less boring*" and "*less time-consuming*"; other times, as already seen *(Section: The classroom*), IWB use is praised because of the greater involvement it creates among actors, closing distance with teachers and allowing a better feeling of participation and sharing during classroom activities. Students' satisfaction with school life appears to be greater when they belong to a classroom approaching the interactional C type, lower if their classroom gets closer to the traditional A type.

Students are aware that, belonging to a generation "*born with technology*", they share an immediate and 'natural' approach to ICT quite different from the more awkward, cautious or fearful one of their parents and teachers. As 'digital natives'[20], they often support 'digital immigrants' that, both at home or at school, ask for their help with ICT use. Their greater technological abilities were however developed through a learning-by-doing process mainly self-taught or driven by imitation or expertise exchange among friends, but lacking any kind of guidance or illustration on the more technical specificities of hardware and software components of

[20] As generally understood, the category of 'digital natives' includes people that were born after the diffusion of ICT, that of 'digital immigrant', those that learned to use them as adults (Gasser & Palfrey, 2008). For a more complex definition, see Riva (2014).

digital devices, not to mention of the wide range of psychological, sociological and ethical issues linked to their use[21]. This explains why several among them suggest that the SDS project should have provided training courses not only for teachers, but also for students, in order to introduce them to the technicalities of the IWB and the annexed software, without taking for granted the wrong equivalence between 'digital natives' and 'technology experts'.

The common condition of digital natives should have allowed, in theory, both male and female students to equally benefit of the attribution of 'technological experts'. The analysis, however, shows how the relation between technological expertise and gender varies, in practice, according to students' fields of action (Bourdieu, 2010).

Within households, both boys and girls seem to be fully legitimated as 'techno-experts', following a generational criteria distinguishing them from their 'digital immigrant' parents, in constant need of assistance with ICT devices. When at home, girls bring into place their technological proficiency in a full and self-assured manner, disclosing both 'soft mastery' as well as more 'hard mastery' skills.

> FG6- Lyceum
> Moderator: Do your parents ask you for help in the use of the computer?
> Francine: Yes! (…) Dad, if he has to search something on You Tube and it halts, or if he has to watch a game on Sky Go: "Why is it so slow? Why doesn't it move? Why doesn't it turn on?": so I intervene! Mom, because she gets in a panic, because maybe she pushes too much the keys or opens too many windows and clearly the system can't make it, it gets stuck. So she starts: "Why did it stop?!? I was working: help me!". She has to understand that she can't use it this way!

> FG8 - Lyceum
> Helena: [In a power point presentation] I always look for a music that is suitable… All things that [teacher] taught us in middle school, where they made us work a lot with power point… in general with power point I can mess around quite a bit…
> Moderator: With what else do you like to mess around?
> Helena: A bit with everything: if I have the computer I try to download stuff even if its forbidden… otherwise with the television, since I have the smart TV, I like to stay there and try all applications… It might seem silly, but I

[21] Those include issues ranging from abuse of privacy rights and harassment to sources selection and quotations, scientific accountability of information, risk management for data loss, dependency in use.

like to stay there to look at the news, it's a kind of passion that my dad passed down to me…

Within the classroom, however, the attribution of technical competence on a generational basis (rewarding students over teachers) is often crossed by a gender criterion, recovering the traditional definition of technology as a sphere of primarily masculine pertinence (thus rewarding boys over girls). These mechanisms can be seen at work mostly in the 'traditional type' classrooms, where observations and focus groups show the prevalence, in IWB use, of actors' behaviour oriented by stereotypes on technology and gender: when experiencing problems with the whiteboard, for instance, teachers tend to call for help some of the boys identified - and defining themselves - as technological geeks, not necessarily confirming in practice their presumed higher abilities; by contrast girls, proving self-confidence in ICT use within the household, show insecurity and fears IWB use within the classroom.

FG8 – Lyceum
Hannah: Quite often teachers do not how to use it [the IWB], so someone among us goes and helps them (…)
Moderator: Is it the teachers calling you for help or you go out of your initiative?
Henry: Both the cases; if I feel benevolent I get up [*with sarcasm*] (…)
Moderator: Is it only boys helping teachers? Girls never get up?
Helena: No, absolutely not!!!
Moderator: Why not?
Helena: I don't know, it's better if the others get up, it's better if I don't! [*laughing*]
Hannah: I can't use [the IWB]: maybe [I can do] the main things, but how it all works, no…

FG6- Lyceum
Flo: I have to say that some of us, especially we girls, we really fear to use it [the IWB], because we fear to make a fool of ourselves! [*everyone smiles*]
Moderator: Why do you say it is especially you girls? (…)
Farah: Yes, it's true…
Flo: Given that in our case [in the classroom] it is mostly boys that know how to use technology, as for John [*she smiles pointing at her classmate*], personally I feel a little ashamed of going there and mess up!

The quotes reported above show how the tacit rules adopted by students in their use of the new device within the classroom still refer to traditionally defined gender roles: on the one hand, the male bias in the typical technology definition leads to a presumption of masculine competence, creating the contrast between boys' self-confidence and girls' insecurity; on the other, stereotyped gender role models, asking men to be assertive and confident in the public sphere and women reserved and focused on the private one, are reflected in girls' reluctance to stand near the IWB in front of the class.

Although, as previously discussed, studies on education have widely ascertained the presence in school of hidden processes of gender differentiation continuing to operate despite gender neutrality of the official curriculum, interviewed teachers and students do not seem to be fully aware of the presence of these mechanisms. When asked on the reasons behind their fears and embarrassment in using the IWB, girls report it to their lack of practice, related to teachers' tight control on student's use (defining classroom type A), leaving unsolved the question of why male classmates do not seem to share the problem (at least not to the same extent).

> Fiona: To me, it is a question of practice, I mean, if they [the teachers] would allow us to use it [the IWB] a little more, I wouldn't have any problem to go [at the IWB], because I also went two or three time to use it and I always had problems because, since I had never used it, you don't know how it works, do you understand? (…)
> Farah: As Fiona said, it's a question of practice: if we [the class] would use it daily, clearly I don't think that we would be anyone worried or ashamed of using it.

Feminine competence with technological devices, however, finds a way in other classroom types (B and C in figure 1): observations in classrooms showed girls' particular attention for the expressive and communicative functionalities offered by the whiteboard, while focus groups confirmed their greater expertise - *vis à vis* their male classmates - in the use of smartphones, exploited both for personal and educational reasons, through an active participation to social networks.

> FG6 - Lyceum
> Flo: I'm not that technological... I mean: just the right amount, I'm not like Felix…
> Moderator: He seems to be your terms of reference…

Flo: He's a technology genius!
Felicity: However with the smartphone he's not hyper technological at all!
(…)
Flo: Honestly speaking, it has been months since I haven't touched the computer (…) because I do everything with the smartphone!
Moderator: You use the smartphone also to do research in the internet?
Flo: [Yes!] I find it comfortable, because I can go everywhere having the internet connection in the smartphone and I can also use it outside home… the smartphone is more practical… then, of course, if I have to use power point I use the computer…

FG7 – Professional institute
Glenda: [With Whats'up] we also exchange homework…
Gary: Such as: "What do we have tomorrow?" or what? [interrogative tone]
Gloria: Well, not you: only among us girls…
Gaia: We removed the men, because they didn't answer!
Gary: [*By a way of justification*] Ok, but if I open the smartphone and I find 300 new messages!!!
George: No, but we also have the Facebook classroom group!
Moderator: Do boys participate to the Facebook group?
Gary – Yes!

As also suggested in the quotes above, girls' greater expertise in the use of smartphones does not allow them to compete for the role of classroom's technological expert, which remains a prerogative of the male 'computer geeks'. Also, their competencies with the communicative and expressive aspects of the IWB use, noticed during focus groups and observations, do not seem to be rewarding. In fact the still limited use of the IWB in 'type B' classrooms leads teachers and students to associate the new device primarily to the 'old' computer, with which it shares some basic hardware and software items, leaving largely uncharted its potential concerning communication, media integration and interaction.

Those features are further explored within 'type C' classrooms, where teachers' conviction in the pedagogical worth of Education 2.0 models, allows them to pay the transition costs required by organizational change[22].

[22]During observations in a tourism geography class, for instance, it was noticed how teacher's acknowledgment of limited technological skills, because inserted within a pedagogical approach foreseeing students' cooperation to the learning process, did not undermine her role's legitimacy. A tentative transition from 'type B' to 'type C' classroom logic was detected when traditional role inversions in teaching was temporarily mirrored by a spatial reconfiguration of the classroom: students (both boys and girls) were asked to

In this type of classroom – more rarely, but increasingly found - teachers deliberately incentive students' integration of various ICT devices within learning activities, breaking barriers between legitimated school knowledge and other forms of (theoretical and practical) knowledge. This also favours a more gender free approach to the use of technology in the classroom, which however does not seem to be followed by a reconfiguration of gender-technology relations at a more symbolic level.

Conclusions

The recent introduction of IWB within school systems has attracted the attention of scholars for its potential in enhancing Education 2.0 models, offering citizens new skills to fully participate to the information society, while ensuring that chances formally offered to all are practically enjoyed also by the more disadvantaged segments of societies. Several studies have outlined that, although IWB might represent a useful support to teaching, its use does not automatically lead to interactive and innovative pedagogies, stressing the crucial role of teachers competent both at the didactical and technological level in ferrying school systems towards Education 2.0 models.

The article confirms these findings, building on the results of a research over a project for the digital innovation of the school system in the region Sardinia. The theoretical approach adopted, recognising the existence of a mutual, complex and dynamic relation between gender and technology, has integrated a series of research tools (ethnographic observations, focus groups, interviews, a questionnaire) to contribute to the in-depth study of classroom organization after IWB introduction. Three types of classroom were finally identified (traditional, transitional, interactive), differing in their spatial organization and form of relational interaction and influencing the articulation of gender-technology relation.

In the 'traditional type' of classroom the new device is adapted to the traditional school model and inserted within the sphere of action of the teacher, who – limiting and controlling its use – retains a gatekeeper role on legitimate knowledge. Aware of their lack of technological skills *vis à vis* a generation of "digital native" students, teachers try to prevent challenges for a possible subversion of traditional rules and hierarchies defining

employ a CD-ROM in the IWB sitting at teacher's desk, while she supervised activities from students' seats.

classroom organization, threatening the stability of the 'natural' school order. The uneasiness with IWB use shown by both teachers and students is often accompanied, in the case of women, by emotions such as fear and anxiety, revealing the influence of traditional ideology on gender and technology.

In the 'transitional type', rules organizing the classroom formally remain as in the traditional one, while teacher-students relations shift from a directive to a cooperative interaction, through the gradual integration of IWB within daily classroom activities. It is Education 2.0 models' enhancement of long-awaited innovative approaches, that persuades teachers to face their technological limits, overtaken through the cooperation of their digital native students. The involvement of the students, called upon by the teachers to ensure the well-functioning of the learning process, also allows girls to put aside their fears, gaining increasing confidence with IWB use.

In the 'interactive type' of classroom, the increasingly cooperative nature of teacher-students interaction is reinforced by a spatial reconfiguration of the classroom in networked structures, redefining the understanding and contours of knowledge production, learning processes, evaluation criteria. The enhancement of both 'soft' and 'hard' technological skills (often associated, respectively, to the feminine and masculine identity), deriving from the integration of devices used by students outside the school within classroom activities, indirectly favours a more gender free approach to the use of technology.

In summary, the shift to Education 2.0 models observed after the introduction of IWB within classrooms, although still limited in extent, leads to the adoption of innovative didactical practices, less gendered also in technology utilization. Those changes, however, have not (yet) led to a wider symbolic reconfiguration of traditional conceptions in the relation between gender and technology. While highly proficient with Education 2.0 models, both at the technical and didactical level, ELT – often women – are seldom offered formal responsibilities at the institutional level, usually assigned to male teachers; although frequently more skilled than their male classmates in the use of smartphones, girls are not assigned the role of 'technical expert' of the classroom, which remains a prerogative of the (male) computer geek of the class.

The lack of attentiveness over these contradictions, observed among teachers and students interviewed, reveals how the historically male biased definition of technology is still inbred within the school system, were it becomes internalised by actors, through legitimated forms of 'symbolic

violence'[23]. For these reasons, the authors believe that policies for the technological innovation of education systems should dedicate a special attention, within their wider promotion of a reframing of traditional models according to innovative pedagogical approaches, to the definition of gender and technology relations responding to a more egalitarian logic.

The authors would like to thank the two anonymous referees, for their useful comments on a previous version of the article. Although the article is the result of shared research activities and reflections of the authors, to ascribe formal responsibility, A. De Feo wrote the following sections *The research: the gender dimension of the Sardinia Digital School project, The Teachers* and *Conclusions*; all other parts were written by C. Casula.

This article was written as part of a research project funded by the Autonomous Region of Sardinia, L.R. 7/2007 (Annualità 2011, CRP 49311 - European Social Fund). Title of the project: *La Rivoluzione digitale nella scuola sarda. Caratteristiche strutturali del sistema, culture professionali, organizzative e didattiche di fronte alla sfida dell'innovazione*. Principal investigator: Prof. Marco Pitzalis, (CIRD-REC: University of Cagliari and University of Sassari).

References

Abrahams, J. (1995). *Divide and School: Gender and Class Dynamics in Comprehensive Education.* London: Falmer.

Abbiss, J. (2011). Boys and machines: gendered computer identities, regulation and resistance, *Gender and Education*, *23*(5), 601-617.

[23]Pierre Bourdieu defines symbolic violence as that subtle and soft form of power exercised over a social agent with his/her complicity in order to legitimize dominant positions and social order (Bourdieu, 1998).

Abbott, P., Wallace, C., & Tyler, M. (2005). *An Introduction to Sociology: Feminist Perspectives.* London and New York: Routledge.
Acker, S. (1994). Gendered Education. Buckingham: Open University Press.
Ballarino, G., & Checchi, D. (Eds.) (2006). Scelte scolastiche e disuguaglianza sociale. Bologna: Il Mulino.
Barone, C. (2011). Some Things Never Change: Gender Segregation in Higher Education across Eight Nations and Three Decades. American Sociological Association, 84(2), 157-176.
Beauchamp, G., & Kennewell, S. (2010). Interactivity in the Classroom and its Impact on Learning. *Computers & Education*, 54, 759-66.
Bernstein, B. (1971). *Class, Codes and Control: Theoretical Studies Towards a Sociology of Language.* London: Routledge & Kegan Paul.
Bourdieu, P., & Passeron, J.C. (1970). La Reproduction. Éléments pour une théorie du Système d'enseignement. Paris: Minuit.
Bourdieu, P. (1998). *La domination masculine*. Paris: Seul.
Bourdieu, P. (2010). The Form of Capital. In I. Szeman & T. Kaposy (Eds.), *Cultural theory: An anthology* (pp. 81-93). Oxford: Wiley-Blackwell.
Broadbent, S. (2012). *Internet, lavoro, vita private. Come le nuove tecnologie cambiano il nostro mondo.* Bologna: Il Mulino.
Burgess, H. (1990). Co-Education – the Disadvantages for Schoolgirls. *Gender and Education*, *2*(1), 91-95.
Calidoni P., & Casula C. (Eds.) (2015). *Education 2.0: esperienze, riflessioni, scenari*. Cagliari: CUEC.
Callon, M., Millo, Y., & Muniesa, F. (Eds.) (2007). *Market devices*, Oxford: Wiley-Blackwell.
Castells, M. (2001). *Internet Galaxy*. Oxford: Oxford University Press.
Castells, M. (2009). *Lecture on Higher Education. University of the Western Cape, 7 August 2009.* Retrieved from http://www.uchile.cl/documentos/lecture-on-higher-education_113390_49_1026.pdf
Casula, C. (2009). The EU and the Information Society: from e-knowledge to e-inclusion, in search of global leadership. In F. Amoretti (Ed.), *Electronic Constitution. Social, Cultural, and Political Implications* (pp. 86-98). Hershey-PA: IGI Global.
Casula, C., & De Feo, A. (2015). Genere e attribuzione di competenza nella Scuola 2.0. In P. Calidoni, C. Casula (Eds.), *Education 2.0: esperienze, riflessioni, scenari.* Cagliari: CUEC.
Casula, C., & Mongili, A. (2006). Donne al computer. Marginalità e integrazione nell'utilizzo delle ICT. Cagliari: CUEC.
Clegg, S. (2001). Theorising the machine: gender, education and computing. *Gender and Education*, *13*, 307-324.
Cockburn, C. (1983). *Brothers: Male Dominance and Technological Change*. London: Pluto Press.
Collins, R. (1979). *The* Credential Society*: An Historical Sociology of Education and Stratification.* New York: Academic Press.
Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Cambridge, Mass.: Harvard University Press.
Cutrim Schmid, E., & Whyte, S. (2012). Interactive Whiteboards in State School Settings: Teacher Responses to Socio-constructivist Hegemonies. *Language, Learning & Technology*, *16*(2), 65-86.

De Feo, A., & Pitzalis, M. (2014). Arrivano le LIM! Rappresentazioni e pratiche degli insegnanti all'avvio della scuola digitale. *Scuola Democratica*, 1, 97-115.

Derouet, J. L. (2012). L'Europe: une mise en ordre cognitive? Présentation. *Education et sociétés*, *1*(29), 5-10.

DiMaggio, P., Hargittai, E., Celeste, C., & Schafer, S. (2003). *From Unequal Access to Differentiated Use: A Literature Review and Agenda for Research on Digital Inequality*. Princeton University, Center for Arts and Cultural Policy Studies, Working Paper n. 29. Retrieved from www.princeton.edu/ıarts pol/work-pap29.html

Fele, G., & Paoletti, I. (2003). *L'interazione in classe*. Bologna: Il Mulino.

Fenwick, T., & Richard, E. (2013). Performative ontologies. Sociomaterial approaches to researching adult education and lifelong learning. *European journal for Research on the Education and Learning of Adults, 4*(1), 49-63.

Fisher, C. (1988). "Touch Someone": The Telephone Industry Discovers Sociability. Technology and Culture, *29*(1), 32-61.

Frank, K. A., Zhao, Y., & Borman, K. (2004). Social Capital and the Diffusion of Innovations Within Organizations: The Case of Computer Technology in Schools. *Sociology of Education*, 77(April), 148-171.

Frissen, V. (1995). Gender is Calling: Some Reflections on the Past, Present, and Future Use of the Telephone. In K. Grint & R. Gill (Eds.), *The Gender-Technology Relation. Contemporary Theory and Research.* London: Taylor and Francis.

Gasser, U., & Palfrey, J. (2008). *Born Digital: Connecting with a Global Generation of Digital Natives*. New York: Perseus Publishing.

Ghiaccio, F. (2015). Ruoli, dinamiche partecipative e approcci formativi nel corso on-line di formazione dei Meta Master Teacher. In P. Calidoni & C. Casula (Eds.), *Education 2.0: esperienze, riflessioni, scenari*. Cagliari: CUEC.

Giambona, F., Pitzalis, M., Porcu, M. & Sulis, I. (2015). Insegnanti e innovazione. La scuola sarda e la sfida del digitale. In P. Calidoni & C. Casula (Eds.), *Education 2.0: esperienze, riflessioni, scenari*. Cagliari: CUEC.

Glover, D., & Miller, D. (2001). Running with Technology: the pedagogic impact of the large-scale introduction of interactive whiteboards in one secondary school. *Journal of Information Technology for Teacher Education*, *10*(3), 257-276.

Gold, K. (1990), 'Get Thee to a Laboratory'. *New Scientist*. 14, 42-46.

Goode, J., Estrella, R., & Margolis, J. (2006). Lost in translation: Gender and high school computer science. In W. Aspry & J. M. Cohoon (Eds.), *Women and Information Technology: Research on Underrepresentation* (pp. 89-113). Cambridge, MA: MIT Press.

Greiffenhagen, C. (2004). Interactive whiteboards in mathematics education: possibilities and dangers. In H. Fujita *et al*. (Eds.), *Proceedings of the Ninth International Congress on Mathematical Education* (pp.1-10). Kluwer: Springer.

Hoyles, C. (1986). *Girls and Computers*. London: Bedford Way Paper.

Ingrosso, M., & Spaggiari, E. (2006). Nuove tecnologie e processi formativi. In M. Colombo, G. Giovannini & P. Landri (Eds.), *Sociologia delle politiche e dei processi formativi*. Milano: Guerini.

IMF, OECD, UN, WB (2000). *A Better World for All Progress towards the international development goals*. International Monetary Fund.

Istat (2009). *Cittadini e nuove tecnologie. Anno 2009. Statistiche in breve*, 28 dicembre 2009. Roma

Istat (2010). *La divisione dei ruoli nelle coppie. Anno 2008-2009. Statistiche in breve*, 10 novembre 2010. Roma.

Istat (2014). *Cittadini e nuove tecnologie–anno 2014. Statistiche-report*, 18 dicembre 2014. Roma.
Kelly, A. (1982). Gender Roles at Home and School. *British Journal of Sociology of Education*, 3, 281-296.
Kelly, A. (1987). *Science for girls.* Buckingham: Open University Press.
Lee, M., & Winzenried, A. (2009). *The Use of Instructional Technology in Schools*. Melbourne: ACER Press.
Lindroos, M. (1995). The production of "girl" in an educational setting. *Gender and Education*, *7*(2), 143-155.
McCormick, R., & Scrimshaw, P. (2001). Information and Communications Technology. *Knowledge and Pedagogy, Education, Communication and Information*, *1*(1), 37-57.
McNair S. (2000). *The Emerging Policy Agenda. In OECD, Schooling for Tomorrow. Learning to Bridge the Digital Divide*. Paris: OECD Publishing.
OECD (2010). *Inspired by Technology, Driven by Pedagogy. A systemic approach to technology-based school innovations*. Paris: OECD Publishing.
OECD (2015). What lies behind gender inequality in education?. *PISA in Focus*, 03 (March), 49.
Pandolfini, V. (2015). Valutare l'impatto delle ICT a scuola: alcune riflessioni sull'uso di indicatori. In P. Calidoni, C. Casula (Eds.), *Education 2.0: esperienze, riflessioni, scenari.* Cagliari: CUEC.
Pitzalis, M., & De Feo, A. (2016). La logica delle cose. Per una socioanalisi dell'innovazione tecnologica in classe, *Scuola democratica*, 1, 45-65.
Reay, D. (2002). The Paradox of Contemporary Femininities in Education: Combining Fluidity with Flexibility. In B. Francis & S. Skelton (Eds.), Investigating Gender. Buckingham: Open University Press.
Reyneri, E., & Scherer, S. (2008). Come è cresciuta l'occupazione femminile in Italia: fattori strutturali e culturali a confronto. *Stato e mercato*, 83, 183-216.
Riva, G. (2014). Nativi digitali. Crescere e apprendere nel mondo dei nuovi media. Bologna: Il Mulino.
Roehl, T. (2012). Disassembling the classroom. An ethnographic approach to the materiality of education. *Ethnography and Education*, *7*(1), 109-126.
Salehi, H., & Salehi, Z. (2012). *Integration of ICT in language teaching: Challenges and barriers, Proceedings 3rd International Conference on e-Education, e-Business, e-Management and e-Learning*. IPEDR, 27, IACSIT Press, Singapore.
Saraceno, C. (1980). *Il lavoro mal diviso*. Bari: De Donato.
Saraceno, C. (1992). Donne e lavoro o strutture di genere e lavoro?. *Polis*, 1,123-145.
Sartori, L. (2006). *Il divario digitale. Internet e le nuove disuguaglianze sociali*. Bologna: Il Mulino.
Schizzerotto, A., & Barone, C. (2006). *Sociologia dell'istruzione.* Bologna: Il Mulino.
Sharpe, K. (1995). *Just Like a Girl.* Harmondsworth: Penguin.
Skelton, C. (1993). Women and Education. In D. Richardson & V. Robinson (Eds.), *Introducing Women's Studies*. London: Macmillan.
Skelton, C. (2002). Typical Boys? Theorising Masculinity in Educationl Settings. In B. Francis & S. Skelton (Eds.), *Investigating Gender.* Buckingham: Open University Press.
Somekh, B. (2004). Taking the sociological imagination to school: An analysis of the (lack of) impact of information and communication technologies on education systems. *Technology, Pedagogy and Education, 13*(2), 163-179.
Stepulevage, L. (2001). Gender/Technology Relations: complicating the gender binary. *Gender and Education*, *13*(3), 325-338.

Tagliagambe, S. (2010). Gli ambienti di apprendimento. *Scuola democratica*, 1, 165-172.
Tamanini, C. (Ed.) (2007). *Maschi e femmine a scuola: stili relazionali e di apprendimento. Una ricerca su genere e percorsi formativi*. Trento: IPRASE del Trentino.
Turkle, S. (1984). *The Second Self: Computers and the Human Spirit*. London: Granada.
Turkle, S., & Papert, S. (1992). Epistemological pluralism and the Revaluation of the Concrete. In I. Harel & S. Papert (Eds.), *Constructionism*. Norwood (N.J): Ablex.
Vieluf, S., Kaplan, D., Klieme, E., & Bayer, S. (2012). *Teaching Practices and Pedagogical Innovation: Evidence from TALIS.* Paris: OECD Publishing. doi: http://dx.doi.org/10.1787/9789264123540-en
Viteritti A. (2014). L'innovazione in bilico. Oggetti e soggetti emergenti nel campo educativo. *Scuola Democratica*, 3, 605-620.
Wajcman, J. (1991). *Feminism Confronts Technology*. University Park: Pennsylvania State University Press.
Wajcman, J. (2007). From Women and Technology to Gendered Technoscience. *Information, Communication & Society*, *10*(3), 287-298.
Wajcman, J., Bittman, M., & Brown, J. (2009). The Mobile Phone, Perpetual Contact and Time Pressure. *Work, Employment and Society*, *23*(4), 673-691.
Warrington, M., & Younger, M. (2000). The Other Side of the Gender Gap. *Gender and Education*, *12*(4), 493-508.
Webster, J. (1989). *Office Automation: The Labour Process and Women's Work in Britain.* Harvester Wheatsheaf, Hemel Hempstead.
Winzenried, A., Dalgarno, B., & Tinkler, J. (2010). The interactive whiteboard: A transitional technology supporting diverse teaching practices. *Australasian Journal of Educational Technology*, 26, (Special issue, 4), 534-552.
Wolpe, A-M. (1988). *Within School Walls: The Role of Discipline, Sexuality and the Curriculum*. London: Routledge and Kegan Paul.
Wu, H.K., Hsu, Y.-S., & Hwang, Fu-K. (2007). Factors affecting teachers adoption of technology in classroom: does school size matter? *International Journal of Science and Mathematics Education, 6*, 63-85.