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APPUNTI PER UN PROGETTO DI RICERCA SUL RAPPORTO FRA ADOLESCENTI E INFORMAZIONE SCIENTIFICA SU INTERNET

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[Notes for a research project on the relationship between teenagers and scientific information on the Internet]

Tommaso Castellani, Adriana Valente
2013, 14 p. IRPPS Working paper 58/2013.

In this working paper we have collected some working notes for the development of an interdisciplinary research on the interaction of Italian teenagers with the scientific information available on the Internet. Despite Internet results to be the main instrument of information of teenagers, much less is known about how much the young web users are able to select and evaluate the information. In order to analyze the problem and to study a possible intervention with an action-research approach it is necessary to join competences on sociology of science and science education.

Keywords: Digital Literacy, Digital Native, Science Education, Social Network

Appunti per un progetto di ricerca sul rapporto fra adolescenti e informazione scientifica su internet

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2013, 14 p. IRPPS Working paper 58/2013.

In questo *working paper* abbiamo raccolto alcuni appunti di lavoro per lo sviluppo di una ricerca interdisciplinare sull'interazione tra gli adolescenti italiani e l'informazione scientifica reperibile su internet. Malgrado internet risulti essere il principale strumento di informazione degli adolescenti, è molto meno chiaro quanto i giovani utenti del web siano in grado di selezionare e valutare l'informazione. Per analizzare il problema e studiare un possibile intervento con un approccio di ricerca-azione, è necessario unire competenze di sociologia della scienza e di didattica della scienza.

Parole chiave: Alfabetizzazione Digitale, Nativo Digitale, Didattica della Scienza, Social Network

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Indice

1. Introduction

In this paper we have collected some working notes for the development of an interdisciplinary research on sociology and education, following an innovative approach to study the interaction of Italian teenagers with the scientific information available on the Internet.

The Internet has undoubtedly opened new unexpected opportunities for the communication and sharing of knowledge. Nevertheless, as happened for the revolutionary invention of the printing in the 15th century, the availability of a new technology for mass communication brings new challenging problems together with new possibilities.

It has been noted that printing produced not only new ways of progress but "caused at the same time new forms of mystification, [...] contributing to spread incorrect knowledge" (Eisenstein 1983). The same is happening with the Internet, on which a number of unreliable websites concur to disseminate wrong or even dangerous information.

This problem is particularly troublesome regarding scientific information. It is worth to note that scientific information plays a relevant role in the modern democracies, as the complexity of public decisions requires more and more highly specialized knowledge (Castellani and Valente 2012). In this framework many questions are raised on the role of citizens' knowledge in the implementation of participative models. How much of the scientific and technical knowledge can be actually shared with the citizens? How to guarantee the correct information of the citizens? How can the informative and consultative dimensions of participation be balanced? (Dahl 1994).

These questions led to the development of the concept of 'scientific citizenship' as the active and aware participation to the democratic process in the knowledge society, which include information gathering and evaluation by the citizens. Since the Internet undoubtedly represents a crucial tool to achieve a better scientific citizenship (Irwin 2001), it is crucial to investigate how the younger generations can take advantage of it.

In Par. 2 we present a brief analysis of the literature on the relationship among young people and the digital information. In Par. 3 we summarize some experiences on the topic conducted by our Research Unit. In Par. 4 we outline a possible research activity to further develop the theme and in Par. 5 we illustrate the envisaged impact of such a research.

2. Context analysis

At Italian and European level, "Digital Literacy" is considered a *citizenship competence*, enabling "lifelong learning" for citizens. In a policy brief published in 2008 by European Commission, Digital Literacy is defined as "the ability to access digital media and ICT, to understand and critically evaluate different aspects of digital media and media contents and to communicate effectively in a variety of contexts" (Ala-Mutka et al. 2008).

Many studies investigated the Digital Literacy of Italian teenagers. The 2009 Report from *Osservatorio sui Contenuti Digitali* defines as "techno-fan" the 50% of young people between 14 and 24. Nevertheless, the debate on digital competences of young people has been more focused on the habits and technical aspects (what media, how much time, what use) than on the

ability of selecting and critically evaluating the information, which is included in the definition of Digital Literacy.

Many studies are focused on the modalities of interaction with technology, stressing the recurrence of elements like multitasking, authorship and sociality of "digital native" (Rivoltella 2003); the latter aspect of sociality produced also researches on the formation of "online identity" in teenagers (Greenhow et al. 2009). In many of these studies an optimistic vision which highlights the ability of teenagers of "activate strategies of decision making and choosing" integrating "the linear and sequential approach to knowledge, typical of alphabetic culture [...] with the complex, global, intertextual approach of technologic culture" (Falcinelli 2012) is alternating with a more critic vision on actual digital competences of young people beyond the technical aspects.

A recent research on Italian teenagers concludes that "when attention is shifted from strictly technical aspects to critical cognitive and socio-ethical dimensions [...] students' knowledge and competences result inadequate" (Calvani et al. 2012). Similar problems have been stressed by studies on students from other countries (Li and Ranieri 2010).

In the present Information Society, citizens are more and more engaged in scientific problems – as global warming, renewable energy, genetic engineering and many others – hence some scientific competences become citizenship competences (Cerroni 2006).

From most recent polls it came out that the Internet is the main instrument of information of teenagers (Avveduto 2012). It is much less clear how much the young web users are able to select and evaluate the scientific information available online, considering also the existence of a number of very charming websites with low or no scientific reliability. To what extent and how the future citizens will be able to take part to the public debate on scientific themes? How much and what sort of awareness is it developed on the modalities of building scientific knowledge?

To analyze these questions and study a possible intervention with an action-research approach it is necessary to join competences on sociology of science and science education.

3. Background experiences

Since decades pedagogues and philosophers of education are developing techniques for stimulating students' intrinsic motivation in learning science and participating in the scientific debate, and in particular dealing with relevant socio-scientific issues (Zeidler and Nichols 2009, Solomon 1992, Cocking et al. 2000, Osborne et al. 2003, Ryder 2001).

Meantime, rationale has been developed in favor of pedagogical practices that enhance teachers' initiative in promoting argumentation and improve quality in pupils' arguments (Jimenez-Aleixandre and Erduran 2008, Driver et al. 2000, Duschl and Osborne 2002, Erduran and Jiménez-Aleixandre 2008, Fillon and Peterfalvi 2004, Hubat and Gaudillère 1992, Kuhn 1993). This approach, aimed to promote argumentation skills in young people, implicitly recognises the complexity in the nature of (modern) science: crucial for the enhancement of science education is the "presentation of plural alternatives requiring students to consider and evaluate the evidence and argument for each" (Osborne 2005).

Learning science following an inquiry-based methodology is particularly effective in the direction of motivating students to learn how to define the framework for their investigation: to select, evaluate and manage scientific documentation in order to analyse a scientific problem; to look for a debate more than a fast-packaged conclusion; and to do all this in contact with the scientific community, contributing to bridge the distance between schools and research centers (Murcia 2009, De Han and Huck 2008, Given et al. 2010, Marble 2007, Buck et al. 2007, Peters 2009, Wee et al. 2007).

The same is true for the introduction in the classroom of debates on socio-scientific issues (Simonneaux et al. 2005, Albe and Simonneaux 2005, Pugh and Girod 2007, Hogan et al. 2000). These debates often rely on scientific papers that are in part contradictory, and their goal is to build a personal opinion on the issue discussed.

New methodologies for learning science can be effective in both the "science for all citizens" (Millar and Osborne 1998, Irwin 2001, Kolstoe 2001, Jenkins 1999, Ratcliffe and Grace 2003) and "Human resources for S&T" (European Commission 2004) approaches, addressing all dimensions of science education and communication: cultural, democratic (Bodmer Report 1985) and economical (Wolfendale Report 1995).

Another aspect concerns the awareness that teaching conveys values together with knowledge, that the communication of information is implicitly and explicitly loaded with epistemological beliefs and beliefs concerning world views, such as for example the human relationship with nature and environment, sexual equality, social equity (Clément 2004 and 2006, Corringan et al. 2007). The results obtained by the analyses carried out within the "Biology, Health and Environmental Education for better citizenship" European Project (BIOHEAD) have provided clear evidence on how biology teachers might share values and beliefs which are in conflict with biological knowledge (Clément et Quessada 2008, Valente et al. 2007) and how texts and images of Life science manuals may be loaded with hidden messages or may completely leave out issues or deep treatment of problems which are crucial for developing informed and responsible future citizens (Agorram et al. 2009, Berthou et al. 2008, Caravita et al. 2008).

An interdisciplinary approach that takes into account many of these elements has been experimented inside the project "PAS – Ethics and Polemics" developed by the CNR research unit "Science Communication and Education" (Valente 2009) and in the "Junior Science Café" activity of the European project "SciCafe" (Belmonte and Castellani 2010).

Within the PAS Project, initiatives for a public debate of scientific controversial issues were held in different Italian towns involving many schools. Emphasis has been placed on supporting an informed dialogue between students to create tacit understanding and collective wisdom. Participative techniques have been used to enhance interaction in classroom and to prepare the students to take an active part in the political and decision-making process. The documentation activity was also in this project one of the most important phases.

In particular, the PAS – Ethics and Polemics methodology:

- is focused on the awareness of the complex nature of science (Latour 1987, Funtowicz and Ravetz 1999, Knorr-Cetina 1999) and on the consideration that, among the six different approaches to STS education (Ziman 1994), the "nature of science" is the crucial one when the

focus of Inquiry Based Science Education (IBSE) methodology is centred on questioning, argumentation, deliberation and on the evaluation of scientific texts. Nevertheless, this last aspect is highly under-represented in science education (Bell et al. 2000). The awareness of the different levels and sources of knowledge included in science is growing in recent years: science's characteristics conform to (Funtowicz and Ravetz 1999) the "post-normal science", where "facts are uncertain, values in dispute, stakes high and decisions urgent". Even when not all the factors are knowable and it is necessary to cope with uncertainties, it is always more important to find a way to cope with scientific knowledge for scientists, teachers and for today's and tomorrow's citizens. Further, science nowadays concerns evolving as opposed to consolidated knowledge: what , with reference to the confluence of disparate and sometimes conflicting scientific approaches and the interaction between science and culture, has been defined as "science in action" (Latour 1987). As much as the awareness of the complexity of modern science grows up, traditional, linear one way of knowledge transmission in science education shows all its deficiency in representing the richness and articulation of the science-society relationship;

- is centred on participative educational methods and on the cooperation of the main actors involved in the public debate on science, and particularly teachers, students, experts and local bodies and stakeholders. The centrality of teachers in applying IBSE and their direct experience of participatory practices is essential in the PAS – Ethics and Polemics methodology: "we would no more expect an adult to teach a child to read if that adult could not read him/herself" (Greenwood and Scribner-MacLean 1997). One step in the direction of overcoming the distance between science and society (European Commission 2007) has been to follow the "participatory turn" (Jasanoff 2003, Lengwiler 2008), involving teachers and students in participatory methodologies as a way to be, and to feel, active part in the scientific debate and to develop cooperative learning (Midoro 1994, Comoglio 1996, Rogers 1978).

The PAS – Ethics and Polemics methodology has been designed and experimented over two scientific-cultural contexts, Italy and UK, involving experts of both countries and Italian teachers. A large number of students has been involved, aged 10-18, coming from lower and upper secondary schools (considering all courses of studies: classical, scientific, technical, vocational).

The project has been tested in relation to multi-disciplinary scientific controversies: Genetic Modified Organisms (2002-2003), electromagnetic pollution (2003-2004), space exploration (2004-2005), the impact of climate change on cities (2006-2007), the fresh water crisis (2007-2008) (Valente 2007 and 2009).

PAS – Ethics and Polemics has been selected by the European project Form-it Take Part in Research (FP6 2006-2008) as one of the good practices among 160 projects of collaboration between research and education; "PAS – Ethics and Polemics: Learning to participate in the scientific debate" is available on the Catalogue of Good Practice Examples (Mayer 2008).

The "Junior Science Café" activity has been developed inside the "SciCafe" project, funded by European Union within the FP7. Junior science cafés are science cafés organised for school students. The innovative aspect of the project is that students are not only involved as audience of the science cafés but are the organizers of the events. The focus is in this way shifted on the

knowledge of the environment of the scientific research rather than on the specific scientific contents. The analysis and selection of sources by school students is the core of the methodology.

The positive results of these innovative experiments suggest that an even more structured and research-oriented project may lead to other important results.

4. Outline of possible intervention

An action-research project on the specific topic of the relationship among young people and scientific information on the Internet should have as main objective the elaboration of guidelines to improve this relationship. These guidelines should be developed starting from action-research activities conducted in collaboration with schools.

A first stage of the project should rely on the state of the art. In this phase existing quantitative and qualitative analysis on the teenagers' use of the Web might be collected and compared, with particular focus on the relationship with popular science. The specific objectives of this phase are the collection of existing data in literature in order to define the qualitative analysis and the following prototype intervention and the identification of possible controversial points to be analysed *ad hoc*.

The second stage should be a qualitative analysis on the modalities of relations of teenagers with online scientific information by means of participative methodologies as focus groups, metaplan, open space technology and similar.

Young people can be involved through school and specific working groups may be activated also for the teachers, in order to gather their point of view and to enhance their awareness on the topic. The specific objectives of this phase are: the identification of specific issues of the interaction of students and teachers with the online contents of scientific information, considering both the media point of view (multimedia, prevalence of video contents, etc.) and the information sharing point of view (role of social networks, mobiles, etc.); the identification of main criticalities of the relationship between teenagers and online scientific information, both from students' and teachers' point of view, also with the aim of enhancing the activities of science communication; the elaboration of a prototype of intervention directed to students and teachers aimed at improving their fruition of online scientific information; and finally fostering teachers' awareness of the problem of selection and evaluation of online sources of scientific information. Further analysis may be performed on possible controversial points emerged from the literature.

In a third stage the prototype of intervention should be tested with a group of students and teachers in order to assess it.

The specific objectives of this stage are the evaluation of the functionality of the intervention (timing, feasibility, link to school curricula) and the evaluation of the effects of the intervention, also by means of pre-post questionnaires with possible follow-up.

The project ends with a fourth very important stage, the elaboration and dissemination of the produced results.

The specific objectives of this phase are: the elaboration of guidelines for teachers to improve the relationship between students and online scientific information; the production of a video for students promoting a better interaction with the online scientific information following the produced guidelines; the production of a publication with the guidelines, which includes articles from students and teachers involved with the description of the experience; and the dissemination of all these resources.

5. Envisaged impact

Digital Literacy is considered one of the strategic elements of European programme i2010 "A European Information Society for growth and employment" and it is recognised as one of the crucial factors in the forthcoming Horizon 2020 programme (European Commission 2011).

In the last year in Italy the debate on the role of technology in education has been particularly rich, whereas a wide discussion on the role of social competences in the use of the information acquired and shared through ICT is only at its starting point.

At the same time Italian educational institutions are also going through a challenging transformation. Competences on information management are crucial for the development of a participative democracy, in particular – but not only – in a framework of e-democracy envisaged to be developed in the next years.

The action-research activities with students and teachers, dealing with scientific topics of global interest, would be at the same time activities of science promotion, with a double impact: *immediate* on the involved groups of students and teachers, and *indirect* giving to researchers useful elements to foster the effectiveness of science promotion activities.

The results of this phase may have a strong impact in contributing to enhance the collective awareness on problems such as global warming, renewable energy, bioethics. A better use of information is crucial in particular to enhance the participation to scientific discussions.

From the point of view of involved disciplines, this approach has its main strength in having an interdisciplinary vision, joining social science competences with educational competences.

It has been stressed many times that pedagogy should rely on the contribution of the different fields of knowledge and not proceed on a separate track with respect to the specific subjects of the teaching.

Another important envisaged impact is the effect of the guidelines on the curricular teaching. To enhance this point, particular attention should be paid on the dissemination of the final publication to schools. In order to ensure a massive circulation of produced recommendations among the teenagers, one of the final activities of the project must be the production of a video to be disseminated with viral strategies.

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