An Exploratory Study on Perceptions and Use of Technology by Novice and Future Teachers: More Information and Less On-Line Collaboration?

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An exploratory study on perceptions and use of technology by novice and future teachers: more information and less on-line collaboration?

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Abstract

The article discusses the factors that affect the choice of teachers to integrate technology in their teaching and presents the results of a questionnaire administered to 805 teachers attending professional development training courses (TFA and PAS) in the Veneto Region (Northern Italy). The research is aimed at collecting data for the development of a teachers training program that is effective in motivating them to a broader and more effective use of technology. The study reveals how teachers still have little consideration for the potential of interactive and collaborative technology, preferring to use technology for searching information and materials rather than for discussion and participation in on-line communities with their peers, in order to improve their teaching and towards a collaborative construction and sharing of knowledge. The study also confirms the findings in the literature on the subject relative to a number of factors (internal and external) that are perceived as obstacles to the decision to integrate technology in education and proposes specific training activities that are useful in order to remove them.

Keywords: teachers education, teachers beliefs, technology integration, interactive/collaborative technologies.

1.Introduction

This exploratory study of N = 805 training teachers, arises from the need to understand what are the perceptions, beliefs and the actual use of technology by teachers that participate in the Active Internship Training Arogram (TFA-Tirocinio Formativo Attivo) and in the special courses to obtain their qualification (PAS-Percorsi Abilitanti Speciali) in the Veneto Region (Northern Italy). In Italy compulsory education lasts for 10 years (from 6 to 16 years of age) and it covers 5 years of primary school, 3 years of lower secondary school and the first two years of upper secondary school. TFA is an innovative one-year initial teachers' preparation University course for lower and upper secondary school and is in a programmed number: starting from 2010, it replaced a two-year University-based Specialization training program for teaching in Secondary Schools (SSIS). Unfortunately, the TFA

curriculum has a small number of hours dedicated to laboratories for the acquisition of digital competences. So, the immediate goal of this study was to try to obtain significant data that could be used to develop a more effective training program, both in terms of digital competence, and motivational skills (Muscarà and Messina, 2015) that are capable of actually impacting their teaching practices now and in the future. In fact, there is a lot of research evidence that recommends that teachers have a richer, more continuous and thorough training during their initial apprenticeship (Tondeur et al., 2012) (Krumsvik, 2014) (Polly et al., 2010).

This issue is especially important in Italy as the initiatives of the last twenty years focusing on teachers training, generally have obtained interesting results but always limited to pilot projects or non-structural projects (Galliani, 2014). In Italy there are no dedicated in-service teacher training courses. Teachers can participate in training courses organized in or outside schools, but they are not mandatory and only a small number of teachers attend by their own choice. Courses are organized by public or private bodies and can be financed by school or the Regional School Offices or by teachers themselves. In a year, every teacher has 5 days provided for attending a training program. On the institutional side, the Italian national plan currently includes more professional development actions derived from the National Plan for Digital Schools, (2007). These actions to introduce ICT in schools included four initiatives: a fund to buy Interactive Whiteboards, and three other projects only for a small number of pilot schools (cl@sse 2.0, scuol@ 2.0, "Editoria digitale scolastica" i.e. digital books). The pace of adoption is slow, for example in 2014 only 25% of classroom is equipped with an IW, but the real problem is teachers training and competence in the use of technologies, so the Italian Ministry of Education, University and Research (MIUR) funded specific teacher training for at least three teachers per pilot school.

In Europe, including Italy and the majority of countries, the most important surveys (e.g. SITES 2006, TALIS 2008) illustrate that teachers reveal a sense of inadequacy with respect to their competence in the use of technology. In the Italian context, the IARD study (2008) confirms the resistance on the spread of e of digital technology in education: their use is not reflected in a particularly favorable attitude in teaching: although 57% considers them an important teaching tool while only 6% consider them an irreplaceable support for teachers (Gui, 2010). More recently, the results of the last OECD report (Avvisati et al., 2013, p.25) reveal that despite that 50% of teachers have attended at least six days of technology training in the two previous years, it's revealed that the use of technology in the

classroom is still sporadic at all school levels (the answers ranged from "never or almost never" to " a few times a month"). This does not seem to be a problem with the availability of technological resources in Europe (European Commission, 2013) as for example the number of computers and their frequency of use does not appear to be correlated: some countries with the highest rate of technology use are also those with fewer resources.

2.Theoretical Framework

Considering the *barriers* that could discourage teachers in introducing technology in their educational activities, in general research on the subject tends to distinguish between *external* obstacles or context dependent (technical and economic resources available, with access to training, availability of technical personnel, availability of the institution of innovation, national education policies) and *internal* or personal obstacles (attitudes, beliefs, knowledge and skills) (Ertmer, 1999, 2005, 2012; Gallego & Masini, 2012). Another important factor is the conflictual relationship between use in a formal (school) environment and use in an informal environment (everyday life): the adoption of new technologies in society in fact does not usually result in an immediate and corresponding application in schools, which are much slower and constrained by an inflexible curriculum and typical limitations of a traditional educational setting. Moreover, even when the technology is introduced, it's rarely used in interdisciplinary contexts that are meaningful and constructive (Jonassen, 2006; Ertmer & Ottenbreit, 2013); rather it is in fact intended for occasional use and complementary activities (Donnelly, McGarr, & O'Reilly, 2011), or to modify, professional performance (Muscarà & Messina, 2015). Another interesting aspect about the influence of the informal on the formal concerns the greater propensity of teachers to use technology in the classroom if they already make use of it outside of school (Kumar and Vigil, 2011; Lei, 2009; Petrucco & de Rossi, 2014).

That the lack of use of technology in the teaching/learning context is not only a problem related to the availability of technology, but also to the adoption of alternative pedagogical educational paradigms, is supported by a lot of research. Reseach shows that a real added value is achieved only when the technology fits into areas characterized by constructivist approaches to significant learning (Abrami et al., 2011; Schmid et al. 2014). With respect to this, enlightening is, for example, the analysis regarding the different ways that the LIM (Interactive Whiteboard) is used by teachers: many still just use it as a powerful projector (Bonaiuti, 2009; Hall, 2010) without obtaining a significant value added in their

teaching practices, compared to using traditional blackboards. An element for further reflection in this regard relates to the fact that teachers with a higher aptitude towards a constructivist approach to teaching tend to make a greater use of technology. (Chai, 2010; Ertmer et al, 2014; Hermans et al., 2008).

In general, however, from the literature of reference there emerge a number of personal factors that highlight the resistance from teachers against any new technology to be used in the classroom (Kay 2006; Avidov & Eshet, 2011; Lloyd & Albion, 2009; Sang et al., 2010)): including the perception of their inadequacy in their proper use, which causes anxiety (Celik & Yesilyurt, 2013), a propensity to "not-dare" (risk-aversion) (Howard, 2013; Lei, 2010) and the consequent perception of poor self-efficacy (Abbitt, 2011; Compeau and Higgins, 1995; Holden and Rada, 2011). This is followed by a *lack of motivation* and a collaborative climate with colleagues, and finally, a *lack of confidence* that technology can actually contribute to the improvement of the processes of teaching / learning (Conole, 2010; Persico & Wells, 2013). The perception of the *usefulness* and ease of use round up this list so rich in factors that need to be taken into account when considering the limited use of technology in education (Venkatesh et al., 2003). Finally, the presence of a community of practice may play a larger role in promoting changes in teacher attitudes and practices with technology (Kopcha, 2012).

There have been models that have been developed that try to identify the effects of certain personal and environmental factors and their most important causal relationships on the process of adoption of technology in education: for example that of Inan, and Lowther (2010) identifies mainly variables related to age, number of years spent teaching and the availability of support, with the beliefs and perceptions of the skills required to integrate technology in education *(Teachers' Readiness)*. One other model (Teo, 2010 & 2014) derived from research on 700 teachers also examines more specific variables that contribute to the decision to use technology in the classroom like

1) the perception of real benefits,
2) personal attitudes,
3) the effort deemed necessary to implement them,
4) the importance given to the opinion of other colleagues on how much you should use technology (subjective norm), and finally,
5) the conditions that facilitate their application.

All of these variables seem equally good positive or negative predictors. More recent related investigations (Muscarà & Messina, 2015) have used the Italian version of the ITIS scale Intrapersonal

Technology Integration Scale, Benigno et al. (2013), taken up by Niederhauser and Perkmen (2008) to try to determine the effects of beliefs about technology of teachers in training: in this case, the factors, along with the frequency of use, focus on self-efficacy, personal interest, improvement of professional services, and the aforementioned belief about a favorable opinion of colleagues with respect to the use of technology in the classroom. Interestingly, in this study, also the topic of gender came up: male teachers reported higher scores than the group of females, on the perception of competence in the use of technology and this result seems to confirm other studies on the subject (Tezci, 2011). Other interesting results include the role that the number of years spent teaching plays: a greater number of years seems to be correlated with more frequent use of technology in teaching activities; However, this does not ensure that more senior teachers will perceive themselves as more competent in the integration of technology in their teaching. Finally, a fact to be noted is that related to the degree of perceived *self-efficacy and outcome expectation*, higher values of the above are measured in the group of teachers in possession of a free-lance professional license (architects, engineers etc.).

Trying to synthesize the findings from the national and international literature, we have been able to define an agile model (Petrucco, 2015) (fig.1), which, without claiming to be exhaustive, will help to highlight the relationships and the main factors involved in the teachers decision to implement the use of technologies. *Extrinsic factors* can affect *intrinsic factors*: for example there is a relationship between the influence of the community of teachers on the individual (through face-to face interactions and increasingly on-line). The *intrinsic factors* (teaching methods, personal attitudes and the perception of self-efficacy, of competence on Technological Pedagogical Content Knowledge, and on efforts needed) can influence the beliefs about the usefulness of technology in education and the performance expectations. Most of the research shows also that the important factors on which to work on in order to encourage greater and better integration of technology in education are: a) participation in a Community of Practice, b) the adoption of constructive *student-centered* teaching approaches, and c) a teacher training not only focused on the technical but also the pedagogical aspects. The focus on community is especially relevant because the absence of innovators or early adopters that share their practices in a community negatively impacts the likelihood that teachers will adopt technology (Aldunate & Nussbaum, 2013).
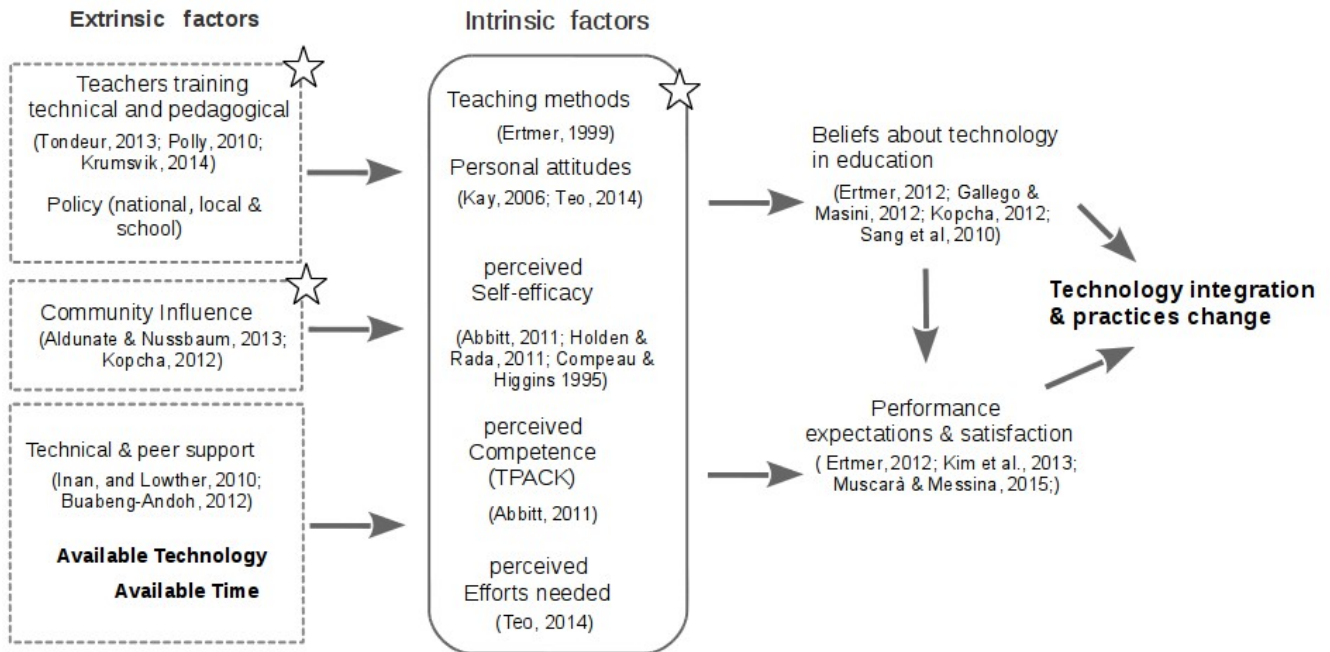
Fig. 1: A model representing the main factors that affect the integration of technology in education. and their relationship to each other elaborated from the literature.

(Niederhauser and Perkmen, 2008; Kay, 2006; Avidov & Eshet, 2011; Teo, 2010 & 2014; Abbitt, 2011; Inan, and Lowther, 2010; Compeau and Higgins, 1995; Conole, 2010; Persico & Wells, 2013; Holden and Rada, 2011; Venkatesh et al., 2003; Ertmer, 2012; Gallego & Masini, 2012; Kopcha, 2012; Sang et al, 2010; Tondeur et al., 2012; Krumsvik, 2014; Polly et al., 2010).

3. The Research

The context and the Learning objective

During the academic years 2014-15 a series of training courses for teachers were organized at the University of Padua and Venice (Northern Italy). At the training, they were provided educational modules during the lessons in "Experimental Pedagogy" specifically dedicated to training integrating the use of technology in school. A questionnaire was administered, adapted from the PEW Report (Purcell et al., 2013) with a dual educational aim:

1) to learn the different cultural, social and teaching / learning contexts of the participants in order to garner information about the use and perceptions of technology - particularly those related to navigation on the Internet – and,

2) to encourage through a discussion about the results, their opinions on the issue of using technology in teaching.

The questionnaire consisted of two sections: the first aimed at obtaining demographic information and characteristics related to personal adoption of the sample subjects; the second aimed to learn some practical use of digital technology both with and outside the school context, and the perceptions/opinions of teachers with respect to: a) the impact of digital technology on the teacher's professional life; b) relationship between students, digital technology and academic success; c) barriers to use/diffusion of technology in school.

Methodology: objectives, sample, procedures

In the above context, there is an ongoing explorative investigation, aimed at taking on the views of the participants and investigate the perceptions and practices stated with relation to technology. Of interest is the fact that these teachers will constitute the user base for a large share of employment of school staff in Italy from which will be drawn from in the next few years, therefore the need to pay particular attention to these subjects in relation to improvement of school practices. The design of the research points to a mixed methodology with the use of investigative qualitative/quantitative techniques (Teddlie & Tashakkori, 2009). It intends to pursue two specific objectives.

1. The administration of the questionnaire - quantitative analysis – the specific objective is to investigate perceptions and use of technology by teachers in education/training.

2. From the qualitative analysis of the content of the discursive interactions on the results of the questionnaire to seek emerging meanings, not identified from the questionnaire, or at least to come to a broader and deeper knowledge than that coming from the data analysis collected with the pre-structured instrument.

Since research is ongoing, we propose, in this article, the presentation and discussion of the results of the first of the two research objectives. The sample consisted of n = 805 teachers teaching different subjects , mean age 43 years. The subjects are in slight majority women, constituting 55.7%, compared to 44.3% of males. 48.6% of the sample has teaching experience at the secondary school senior level, 36.6% at the secondary school junior level, 4.7% at both levels of secondary school, while 2.9% has

experience at other grade levels (from primary school to university) and / or in different organizations / training sectors; only 7.2% has no teaching experience. As for personal adoption of technology, 99.5% of the sample said that they own a computer, 73.1% has a Smartphone and just under half of the sample has a music reader and / or a tablet while 15% say that they have e-book readers or game consoles.

Table 1

Teachers by school level

Secondary school junior level	36.6%
Secondary school senior level	48.6%
Both levels of secondary school	4.7%
Other grade levels	2.9%
No teaching experience	7.2%

The data collected provide account, also, of a population of teachers who use the Internet for reasons comparable to the "average" user, i.e. to work (88.7%), use search engines (96.6%), watch video on YouTube and similar channels (69.3%), and search for information (72%). However, what seems interesting to note is that with regard to the frequency of use of social networks, as many as 36% of people say they do not use them ever or rarely, and only 26.9% log into social environments several times a week or even once a day. The questionnaire data were coded and analyzed using SPSS descriptive statistics software. For each multiple choice item with more than one agreement value, we obtained data relative to the mean and mode of response frequency. We also explored the relationship between the variable gender and the other variables investigated using the chi-square significance tests.

4. Results

With regard to the first of the dimensions investigated, namely that of school practices concerning in particular environments and on-line tools, we asked teachers to indicate, on a scale of 4, how often they performed certain actions relating to information technology, both at school and in their daily life. Considering the average and mode of the answers, the results indicate that digital technology is used daily, or almost daily in order to receive email newsletters and updates about research in their disciplinary area and that the search for materials in order to prepare lessons or to better motivate students are practices that most of the teachers carry out an average of almost once a week. However, we found low values to the answers relating to the interactive and collaborative potential of

technology (see. Fig. 2): "Interact online with other teachers to give or receive tips on classroom management" (μ = 2.4; mode = 1.0) and "Use social networks to exchange ideas with others" (μ = 1.9; Mode = 1.0).
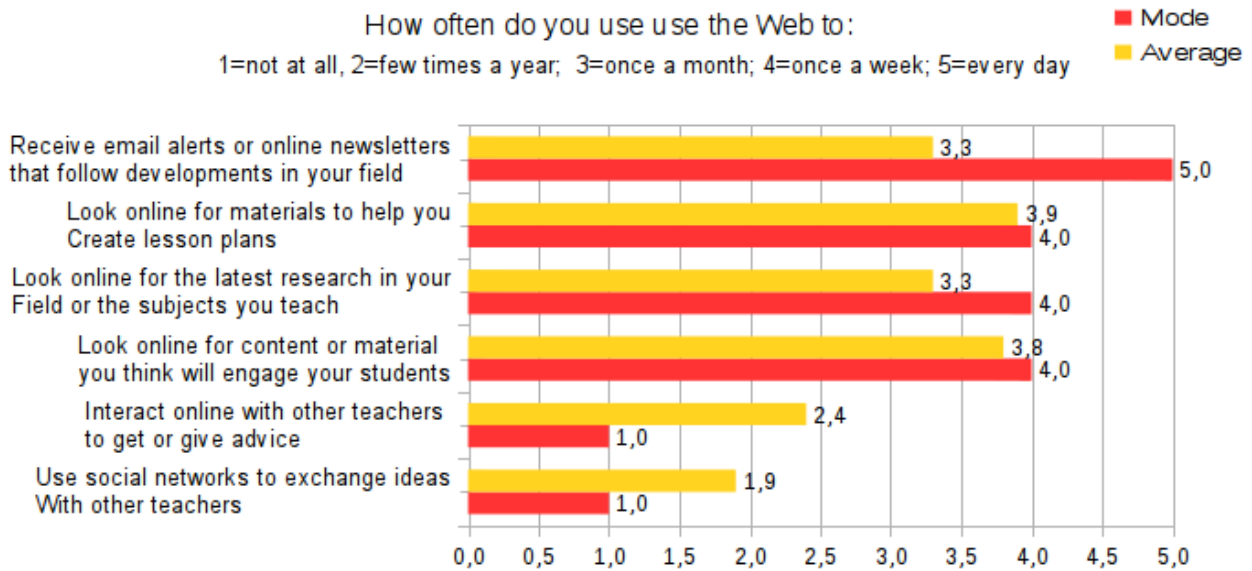

Fig. 2: Mode and Average frequency of responses to an item on the dimension "user practices"

On the other hand, in regards to the question as to what actions are proposed to students through the use of the net, confirms the previous perception: the teachers assign low values to responses such as "Participating in online discussions", "modify or comment on their own work (or that of others) with a collaborative tool like Google Drive "," develop or share their work on a site, wiki, blog "; while most state that they use the net to do research. The lack of consideration about the potential of the interactive and collaborative features of this technology is confirmed in the responses to some items on the second dimension investigated, namely that of *perceptions/opinions* of the other teachers. Analyzing the first aspect of this dimension (the one cited above as "impact of technology on professional life") and considering the question "What impact has the Internet and other digital technologies had on your professional life?".
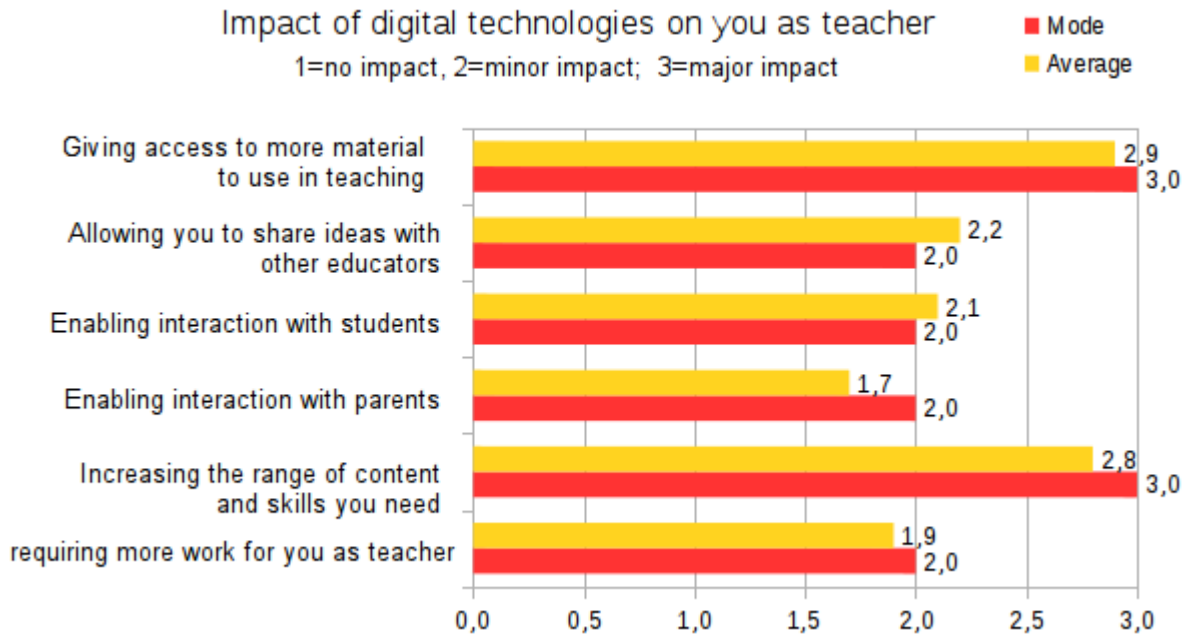
9

Fig. 3: Mode and average frequency of answers to the items related to the perception of the impact of technology as a teacher.

As is clear from Fig. 3, the answers "enabling/facilitating interactions with students" ($\mu = 2.1$; mode = 2.0), and "enabling/facilitating interactions with parents" ($\mu = 1.7$; mode = 2.0) registered rather low values of mode and average. In relation to this aspect, it should however be noted that the application of the chi-square test on the items - in order to assess any significant differences between males and females - shows that female teachers, in contrast to male colleagues, consider that digital technology impacts on their own professionalism, in that they "facilitate sharing of ideas with other teachers" (Pearson chi-square test with df = 2: $\chi^2 =, 040$).

It should be further highlighted that at the same question "What impact has the Internet and other digital technology had on professional life?", The two answers that score the highest according to mode and average are the ones that highlight the "quantitative" potential of the net, to the detriment of the "qualitative" ones. It is recognized, that on the one hand, the net enables easy access to a greater number of resources / information, and on the other hand, that the net entails the need to keep up to date on a greater amount of knowledge and skills. All that aside from the potential (that could be called "qualitative") to modify the quality of relationships, of contacts, of knowledge in itself. With respect to

this same item, it seems interesting to note that the subjects do not seem to consider the use of technology, as the cause for more work for teachers ($\mu = 2.0$; Mode = 1.9). Moving on to an analysis of the items related to a second aspect of the dimension "perceptions / opinions", namely that named "relationship between students and digital technology", the participants were asked to express their agreement / disagreement, expressed on a scale of four, with respect to a series of statements about the relationship between technology and students today. The results of the analysis reported in this section of the questionnaire allow us to highlight some elements of interest. The first concerns the fact that teachers measures, very low values to the statement "students are more adept at the use of media than previous generations" $\mu = 2.3$; Mode = 2.0 (1 min, max 4) (see fig. 4).
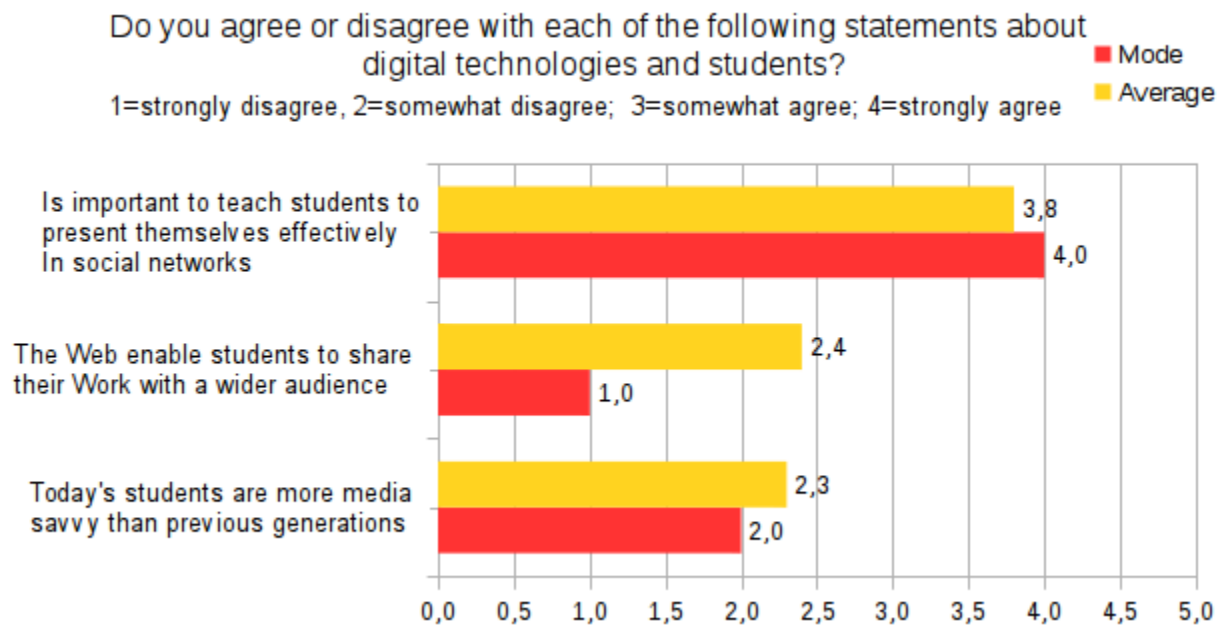
Fig. 4: Mode and average frequency of answers related to some of the teachers' perception of the relationship between technology and students.

A second factor to note concerning this section refers to the considerations that teachers carry out compared to the potential of sharing that is typical of the net, contradicting those made earlier in evaluating the relationship between technology and personal use of the same: in contrast to   when

subjects refer to their experience with digital technologies (see above), here they recognize that these "enable students to share their work with a wider and diverse audience "μ = 3.4; Mode = 4.0 (1 min, max 4). In addition, teachers don't consider that it's important in relation to school success to teach the students to present themselves effectively on Social Network: mean = 2.2; mode = 3.0 (1 min, max 4), indicating implicitly the idea that this ability is not a form of literacy needed today. Nor do they evaluate as a very important form of literacy, to develop the capacity to work with audio, video and graphics, whose relative mean and mode scores on the questionnaire tend to be lower, mean = 2.8; mode = 3.0 (1 min, max 4).

As for the last of the dimensions "perceptions / opinions", the one regarding the obstacles (barriers) that teachers perceive as preventing the integration of digital technology in education, it is interesting to note that the resistance of colleagues and / or directors and / or unfamiliarity with the instruments, are not identified as major difficulties, but rather three types of "lacks": the *time t*o invest, the *resources and / or access* available to students, and *technical support* in schools It should be stressed however that even in this case, with regard to the perception of technology as a collaborative tool presented previously, there are significant differences between men and women: to the question on the importance of the obstacles towards a greater integration of technologies in teaching activities, the three items "lack of time", "resistance from colleagues and managers" and "lack of resources" - submitted to the chi-square test - show values that allow us to consider the attitude of female teachers to be less affected by these obstacles in the introduction of technology at school (significance of (chi-square with df = 2: χ^2 =, 000; χ^2 =, and χ^2 = 000, 043) .μ = 3.6; mode = 4.0 (1 min 4 max); on the other hand, however, they do not judge these "new" skills as a form of literacy: on the item "Today's students are more literate than previous generations" the scores are low μ = 2.3; mode = 2.0 (1 min, max 4).

A second element to note in this section refers to the considerations developed by teachers with regard to the potential of sharing typical of the net, contradicting the considerations made earlier assessing the relationship between technology and their personal use: as opposed to when subjects refer to their experience with digital technology (see above), here they recognize that these "enable students to share their work with a broader and more varied audience" μ = 3.4; mode = 4.0 (1 min, max 4)

It should be stressed, however, that, even in this case, with regard to the perception of technology as a collaborative tool, there are significant differences between men and women: to the question about the importance of the barriers towards a greater integration of technology in teaching, the three statements

"lack of time", "resistance from colleagues and managers" and "lack of resources" – carried out on the chi-square test - have values that allow us to consider the attitude of female teachers as less influenced by such obstacles in the introduction of technology at school (respective significance y (chi-square with df = 2: $\chi^2 =, 000; \chi^2 =,$ and $\chi^2 = 000, 043$).

Discussion

The research here presented gives us a glimpse into the attitudes and practices of teachers in training, both pre-service and novice secondary school teachers with respect to digital technology. The results obtained from the quantitative analysis reveal that, in general, the teachers seem to possess a certain awareness of the need for schools to be more open to the use of technology, introducing in the curriculum content related to the development of digital competence; their answer lead us to consider they do not consider technology as something "negative", i.e. teachers do not seem to perceive technology, as a reason for more work for them, nor consider technology as a cause of distraction from the homework assigned to students. On the other hand there emerges the lack of knowledge about the interactive and collaborative potential of digital technology, in particular of the web. From the analysis it seems that perceptions and uses of technology refer back to those before Web2.0. As shown in figures 2 and 3 above, tools and technology environments are perceived as useful for information research (probably alone), and for an easier access to a greater amount of data, but teachers still do not recognize the interactive and collaborative value of technology in: facilitating school-family and teachers-students relationships, the possibilities for group work, for comparison and discussion, and for the co-construction of knowledge. These teachers' perceptions could arise from the prevailing cumulative conception of knowledge, as they are still deeply attached to the idea of knowledge as a repository of information, rather than as a shared construction potentially achievable with Social Networks.

Furthermore, the many forms of expression that are enabled by technology other than traditional linguistic (text) and in diversified environments with different functions, languages and modes of communication seem to be weakly recognized by teachers, or at least rarely considered as resources in education. This is evident, for example, in relation to the scarce importance that they seem to assign to the creation of skills such as the editing and manipulation of multimedia content (audio, video, graphics), as exlained in the above section. In relation to the challenges that the test subjects claim are the obstacles to the integration of technology in school, it appears from the results that there is a

greater weight given to those obstacles that are defined in the literature as external (due to the context) rather than internal ones. This result is understandable and predictable in Italy, which is marked by schools with scarce resources to set up technologically rich environments supported by adequate technical and economic resources. Finally it seems interesting to discuss gender differences that emerged from the data. In particular, unexpected are the results related to the perception of the obstacles for the implementation of technology in schools. In fact, female teachers consider "lack of time" as a minor difficulty compared to their male colleagues; this is unexpected given the status of women in Italy, where often the woman is burdened, more than men, with multiple family duties on top of having the same professional commitments, and therefore we could expect that the time available to introduce technology in their teaching activities would actually be less than the time available to their male colleagues.

5. Conclusion and future implications

The present study has highlighted a number of specific issues to be considered when teaching and supporting teachers in the use of digital technology more effectively in the classroom. On the whole, the results confirm the recent Italian data (IARD and OECD) which indicates a scarce use of technology by teachers, especially when they have to collaborate on-line with their colleagues. Therefore, the questionnaire data and the first content analysis of the discussions in the forum by the same teachers, seem to suggest the need to include the following in the next training sessions :

> 1) actions aimed at encouraging teachers to develop and participate in communities of on-line practice (professional social networks) to improve their teaching practices with technology and, with the support and help of other colleagues, provide support and motivation to change;
>
> 2) knowledge and field-testing of co-constructive pedagogical and *student-centered* approaches (for instance, Project-based Learning) to stimulate the use of technology in education which is not an end in itself, but which is concrete and meaningful.

Therefore, this may suggest that future institutional policy actions should take greater account of developing collaborative skills in teachers when examining the format of training courses in the use of technology in education as they are useful for the participation in Communities of Practice (Gallagher

et al., 2011), (Daniel, Auhl, & Hastings, 2013) and pedagogical skills-planning in order to organize integrated learning environments. It seems interesting to conclude in this regard, with a reflection on the fact that in different countries with the same availability of technology, their use is significantly higher in just those countries that have innovated their national curriculum in favor of one which is characterized by constructionist approaches (Arrufat & Masini, 2012).

Attribution:

The research was coordinated by C. Petrucco: C. Petrucco wrote the paragraphs. 1 2, 6; V. Grion wrote the paragraphs: 3,4,5,

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