

# Online community building in classrooms and schools: Using the internet to extend teachers' face-to-face community practices

Julio Meneses

Josep M. Mominó

Universitat Oberta de Catalunya. Spain.

jmenesesn@uoc.edu

jmomino@uoc.edu



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## Abstract

Using a digital inequality approach, this study analyses the introduction of the internet into teachers' daily activity in order to support and enhance community building in classrooms and schools. From a representative sample of 350 schools offering compulsory and post-compulsory education in Catalonia (Spain), 2,163 teachers were surveyed. After controlling for school and socio-demographic characteristics, a hierarchical multiple regression analysis was conducted to assess the effects of face-to-face community building and digital literacy. The article analyses their main and interaction effects and discusses the implications of the observed patterns in relation to the introduction of the internet in order to extend and reinforce teachers' face-to-face teaching and professional practices. Going beyond the technological promise, our findings suggest the opportunity to encourage agreement between teachers, school administrators, and policy makers on the importance of a community approach that recognises the value of communication and collaboration as a successful means of addressing the educational challenges of schooling.

**Keywords:** Internet; social interaction and community involvement; teaching and professional practices; digital inequality; digital literacy.

**Resum.** *El desenvolupament comunitari en línia a les aules i escoles: L'ús d'internet per part del professorat com a extensió de les pràctiques comunitàries no mitjançades per la tecnologia*

Utilitzant una aproximació basada en la desigualtat digital, aquest treball analitza la introducció d'internet a l'activitat quotidiana dels professors per donar suport i millorar el desenvolupament comunitari a les aules i escoles. Es van enquestar dos mil cent seixanta-tres (2.163) professors d'una mostra representativa de 350 escoles i instituts que ofereixen educació obligatòria i postobligatòria a Catalunya (Espanya). Una vegada controlades les característiques dels centres educatius i les característiques sociodemogràfiques dels professors, una regressió múltiple jeràrquica va permetre avaluar els efectes de les pràctiques comunitàries no mitjançades per la tecnologia i l'alfabetització digital. L'article analitza els seus efectes principals i d'interacció, i discuteix les implicacions dels patrons observats en relació amb la introducció d'internet com a extensió de les pràctiques docents i professionals no mitjançades per la tecnologia del professorat. Més enllà de la promesa tecnològica,

els nostres resultats suggereixen també l'oportunitat de promoure un acord entre els professors, els equips directius i els responsables polítics sobre la importància d'una perspectiva comunitària que reconegui el valor de la comunicació i la col·laboració com a instruments eficaços per fer front als reptes de l'educació escolar.

**Paraules clau:** internet; interacció social i participació comunitària; pràctiques docents i professionals; desigualtat digital; alfabetització digital.

**Resumen.** *El desarrollo comunitario en línea en las aulas y escuelas: El uso de internet por parte del profesorado como extensión de las prácticas comunitarias no mediadas por la tecnología*

Utilizando una aproximación basada en la desigualdad digital, este trabajo analiza la introducción de internet en la actividad cotidiana de los profesores para dar apoyo y mejorar el desarrollo comunitario en las aulas y escuelas. Se encuestaron dos mil ciento sesenta y tres (2.163) profesores de una muestra representativa de 350 escuelas e institutos que ofrecen educación obligatoria y postobligatoria en Cataluña (España). Una vez controladas las características de los centros educativos y las características sociodemográficas de los profesores, una regresión múltiple jerárquica permitió evaluar los efectos de las prácticas comunitarias no mediadas por la tecnología y la alfabetización digital. El artículo analiza sus efectos principales y de interacción, y discute las implicaciones de los patrones observados en relación con la introducción de internet como extensión de las prácticas docentes y profesionales no mediadas por la tecnología del profesorado. Más allá de la promesa tecnológica, nuestros resultados sugieren la oportunidad de promover un acuerdo entre los profesores, los equipos directivos y los responsables políticos sobre la importancia de una perspectiva comunitaria que reconozca el valor de la comunicación y la colaboración como instrumentos eficaces para hacer frente a los retos de la educación escolar.

**Palabras clave:** internet; interacción social y participación comunitaria; prácticas docentes y profesionales; desigualdad digital; alfabetización digital.

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## 1. Introduction

Although considerable effort has been made to promote information and communications technology (ICT) in schools, a mixture of enthusiastic and critical positions have arisen regarding its expected effects on primary and secondary education. Several commentators (Hepp et al., 2004; OECD, 2004; Trucano, 2005) have discussed their potential—and hopeful—contribution to improving learning results, or at least to achieving them more efficiently. Despite the increasing effort to equip and wire schools around the world

(Eurydice, 2011; Plomp et al., 2009; UNESCO, 2011), the still scarce presence of ICT in classrooms and its limited impact on educational outcomes (OECD, 2011; Scheuermann & Pedró, 2009) have led to scepticism in academic discussion. Even if the faith in technology to solve educational problems were justified, its realisation appears far from providing sufficient evidence to support the public and political debate (Livingstone, 2012; Voogt et al., 2013).

Moving beyond the promise of its effects on traditional outcomes, the main aim of this research is to take an alternative approach and focus on examining the changes that may arise in daily classroom and school activity (Law et al., 2008; UNESCO, 2011). That is, rather than trying to determine a hypothetical influence of technology on student achievement, our concern is to explore how its appropriation<sup>1</sup> by primary and secondary teachers is helping to shape their teaching and professional practices (European Commission, 2013; OECD, 2010; Voogt & Plomp, 2010). Given the new opportunities that ICT – and particularly the internet<sup>2</sup> – offer for fostering interaction and collaboration, this study seeks to examine its incorporation in classrooms and schools to support and enhance community building. Furthermore, we are interested in the relationship between technology and non-technology mediated practices, seeking to obtain more in-depth knowledge about the role that teachers' face-to-face community practices play in their appropriation of the internet for the same purpose.

## 2. Digital inequality in teachers' use of the internet for community purposes

This study uses a digital inequality approach to studying the factors involved in primary and secondary teachers' appropriation of the internet for community purposes, examining its relationship with the corresponding face-to-face teaching and professional practices, and addressing the role that digital literacy plays in this relationship. As has been argued (van Dijk, 2005, 2013; DiMaggio et al., 2004; Hargittai, 2011), the incorporation of the internet into everyday life responds to a complex process of appropriation that is ultimately a function of important factors such as the unequal conditions of access, motivations, abilities, and purposes of use. Digital inequality research has therefore emerged as an alternative approach to the digital divide, in which the degree of digital inclusion was mainly seen as a consequence of unequal access to the internet or the frequency of its use. Instead, the idea of portraying the widening divide between users and non-users as a digital divide needs

1. Although the term "appropriation" is commonly used in situations in which a subject sets an object apart for his/her particular use in exclusion of others, in this paper we use "internet appropriation" to mean the process of the meaningful incorporation of the internet in specific contexts of everyday life.
2. As a result of the perspective adopted in our research, the non-capitalisation of the word "internet" in this paper – as in the common use of terms like "television", "radio", "newspaper", and "telephone" – is a deliberate expression of its daily use and humble nature.

to be revised (Lenhart & Horrigan, 2003; Steyaert, 2002), and a broader view of the social implications of technology has been suggested (Robinson et al., 2003). As we have discussed elsewhere (Meneses & Mominó, 2010), when conditions of access and frequency of use are not the only concern, new research opportunities open up for further examination of such a complex phenomenon.

Digital inequality also proposes a more in-depth analytical framework in order to improve the explanations of why the internet is appropriated unequally. Rooted in the knowledge gap hypothesis (Tichenor et al., 1970), digital divide research typically assumes a mechanical association between greater social and economic advantages and better access or use of information. In this regard, socio-demographic characteristics (i.e., age, gender, education, and income) have commonly been used to examine the differences between users and non-users. While this has been a useful approach for the initial development of the research into the diffusion of the internet, it has also been criticised as being a limited approach to investigating the factors involved in its unequal appropriation (van Dijk & Hacker, 2003; Lievrouw & Farb, 2003; Warschauer, 2003). Even if we only consider the apparent binary gap between users and non-users, ways of overcoming the limitations of an approach that is essentially based on socio-demographic characteristics need to be addressed in a more substantial and comprehensive manner. That is, according to Lievrouw and Farb (2003), through a careful consideration of the unequal interests, concerns, expertise, and actual contexts of internet use involved in its appropriation in everyday life.

Taking this framework as a starting point, this research analyses the incorporation of the internet in order to support and enhance community building in primary and secondary education. After an in-depth analysis of both face-to-face (Meneses & Mominó, 2008) and technology-mediated (Meneses & Mominó, 2012) community practices in Catalan schools, our aim is to explore how the internet is embedded into teachers' everyday activity in classrooms and schools, and to examine its relationship with the corresponding face-to-face teaching and professional practices. Although there has been increasing interest in the progressive incorporation of ICT in classrooms and schools in recent decades, empirical investigation of the specific opportunities for fostering and supporting social interaction and community involvement has, with a few exceptions, not received proper attention.

Among these, we can cite the works by Lin et al. (2008), Duncan-Howell (2010), and Tsai et al. (2010), which studied online communities as professional development tools for knowledge sharing, mutual support, and collaboration between teachers. Suntisukwongchote (2006) examined the new opportunities offered by electronic mail for the same matters, and Warschauer (1995) extended his approach to include student support through single classroom and interclass email collaboration. Moreover, Turcotte (2008) focused on collaboration between students belonging to different classrooms at remotely networked schools, Dardenne (2010) observed the varied types of

use of the internet to enhance school-to-home communication and parent involvement, and Tomai et al. (2010) analysed the benefits of students participating in an online school community. A scattering of partial studies have failed to address online community building in classrooms and schools in a comprehensive and unified manner and have rarely explored its relationship with the corresponding non-technology mediated practices.

In this regard, it is important to note some interesting efforts aimed at studying the different ways teachers interact and collaborate online and face-to-face in developing their professional networks. Analysing patterns of communication, Schuck (2003) acknowledged the perceived value that teachers place on the availability of different means of interaction, including both technology and non-technology mediated, for the development of supportive professional networks. However, although the new means are perceived as flexible and convenient in some cases, teachers still prefer face-to-face encounters with their colleagues. In this respect, Carmichael and Procter (2006) showed an important contradiction between the perceived potential of the internet to support interaction and collaboration and their actual use in teachers' daily activity. Resources, services, and online environments that support the development and sharing of teaching practices in and between schools are scarce and uneven. Instead, online networks in schools usually lead to asymmetrical relationships in which government agencies and commercial providers distribute information rather than encourage teachers to collaborate and support one another. Interestingly, when online means of interaction are developed, they mostly supplement more traditional approaches rather than transform teachers' relational practices. This trend was also observed by Matzat (2010), who stressed the importance of face-to-face relations in the creation of successful conditions to support online interaction between teachers.

To fill this gap in the literature, this study adopts a digital inequality approach to studying primary and secondary teachers' appropriation of the internet for community purposes in a comprehensive and unified way. Therefore, we are not interested in the existence of a divide between those who access or use the internet nor in a differentiated study of the use of available services such as the worldwide web, electronic mail, instant messaging or internet relay chat. Instead, we will focus on the specific purpose for which the internet is incorporated into teachers' everyday activity in order to support the ways classrooms and schools organise their functioning and the opening up of these two contexts to the local community. That is, in the creation of new opportunities for teamwork, participation, and joint responsibility both in classrooms and schools. Likewise, as a result of the approach taken in this study, we analyse the relationship between online and face-to-face community building with the appropriate control for school and socio-demographic characteristics, and address the specific role that digital literacy plays in this relationship.

### 3. Method

The study was conducted as part of the *Catalonia Internet Project*<sup>3</sup> (PIC in Catalan): *Schooling in the network society*, a larger exploratory study of the specific traits in introducing the internet in primary and secondary education in Catalonia, Spain. The PIC's main objective is to address the contribution of the internet to a new educational culture adjusted to the requirements of the Network Society (Mominó et al., 2008). The study's fieldwork was conducted in 2003 with the support of the Department of Education of the Generalitat de Catalunya (Catalan Government) and the Jaume Bofill Foundation, collecting survey data from a representative sample of 350 primary and secondary schools. Given the limited availability of nationally representative data and despite the fact that these data are somewhat dated, they nonetheless offer an excellent opportunity to examine primary and secondary teachers' appropriation of the internet for community purposes in an entire education system. These data have not been used to examine the relationship with the corresponding face-to-face teaching and professional practices, and more recent and comparable data are not known to be available.

#### 3.1. Data collection

A survey was conducted at the end of the 2002-2003 academic year (December 2002-April 2003) of a representative and stratified sample of 350 centres offering compulsory primary (175), compulsory secondary (82), post-compulsory (59), and vocational (34) education. Primary and secondary schools participating in the study were randomly selected from a list of 2,726 centres providing compulsory and post-compulsory education in Catalonia. This sampling frame was developed with the support of the Department of Education of the Generalitat de Catalunya, and was used to determine the sample size with a proportional allocation according to educational level, region, size of town/city where the school was located, and type of funding.

#### 3.2. Participants

The final sample of the study was composed of 2,163 teachers teaching at compulsory primary (36%), compulsory secondary (31%), post-compulsory (25%), and vocational education (8%), who completed an in-school, in-depth, self-administered questionnaire assisted by the research staff. At a confidence level of 95.5%, this research enabled us to obtain statistically representative information on the teaching staff serving in the entire education system in

3. The *Catalonia Internet Project* is an interdisciplinary research programme focused on the characteristics and development of the information society in Catalonia. It is directed by professors Manuel Castells and Imma Tubella, and conducted by researchers from the Internet Interdisciplinary Institute (IN3) of the Universitat Oberta de Catalunya (UOC). See <http://www.uoc.edu/in3/pic/eng>.

Catalonia with a maximum error of  $\pm 2.1\%$  ( $p=q=0.50$  and  $k=2$ ). Thirty-eight percent of the teachers were males, with a mean age of 40.73 (s.d.=9.04), of whom 70% were between 31 and 50 years of age.

### 3.3. Measures

*School characteristics.* The research includes information about the education levels offered (i.e., compulsory primary, compulsory secondary, post-compulsory or vocational education), the school's type of funding (public or private), and the total population of the town or city where it was located. Location information was recorded in a four-level ordinal measure that ranges from less than 5,000 inhabitants to 500,001 or more inhabitants.

*Socio-demographic characteristics.* Participants were asked to provide basic demographic information on age and gender. According to the specific traits of the diffusion of the internet in Catalan society, age was recoded to identify teachers born in 1973 or later. As Castells et al. (2003) have observed, there are several circumstances related to political, economic, and cultural conditions that show evidence of a more prominent role for citizens aged 30 or younger in the transition to the network society in Catalonia. Participants born before 1973 were also grouped into two categories, which included teachers aged between 31 and 50 years old, and teachers aged 51 years or older. Although the effects of age were modest, the three-level ordinal variable resulted in a slightly better fit of the regression models compared to the original measure, and was consequently chosen for this study. Additionally, a measure of the teachers' experience with the internet was built based on their reported frequency of access at home, using a four-level ordinal rating scale ranging from "never or almost never" to "daily".

*Digital literacy.* In order to assess teachers' digital literacy, a list of seven different internet-oriented digital practices (i.e., using a browser, downloading a file, sending an e-mail, adding a link or an attachment, using instant messaging applications, and building a website) was presented. Responses served as proxy measures for observed skills, which are not only much less expensive and difficult to collect for large samples, but also proven to be better predictors in comparison with other measures such as general self-perceived ability (Hargittai, 2005). Answers reporting their ability were coded as seven dichotomous indicators that were ultimately treated as a seven-item scale for the exploratory factor analysis. Given their non-metric nature, principal components analysis (PCA) with polychoric correlation was carried out to validate the resulting measure. A one-component solution was obtained (KMO=0.774 and a significant Bartlett's test,  $p=0.000$ ) with component loadings ranging from 0.751 to 0.913. This solution accounted for 73.22% of the total variance and showed a Cronbach's  $\alpha$  of 0.939.

*Face-to-face community building.* Participants were asked to report their face-to-face teaching and professional practices with regard to five key areas involved in community building both in the classroom and at an organisational level (see Meneses & Mominó, 2008, for further discussion). Teachers reported on a three-level ordinal rating scale that described how frequently (“never”, “occasionally”, or “regularly”) they participate in school decision making, work together with other teachers belonging to their school, are involved in joint educational projects with other schools, are open to the participation of parents in their teaching practices, and are open to the participation of other local professionals from outside their school in their teaching practices. PCA with polychoric correlation showed a one-component solution (KMO=0.762 and a significant Bartlett’s test,  $p=0.000$ ) with component loadings ranging from 0.630 to 0.762. This solution accounted for 51.89% of the total variance and showed a satisfactory level of internal consistency with a Cronbach’s  $\alpha$  of 0.768.

*Online community building.* Participants were asked to report their use of the internet for community purposes both in the classroom and on an organisational level (see Meneses & Mominó, 2012, for further discussion). Using a common approach to face-to-face practices, a list of eight different community-oriented uses of the internet for teaching (i.e., communicating with students, promoting teamwork as a classroom dynamic in their classes, participating in joint educational projects with other schools, and opening up their teaching to parental involvement) and professional matters (i.e., communicating with other colleagues teaching at the same school, collaborating with teachers belonging to other schools, engaging with parents, and interacting with other local professionals from outside of their school) was presented. Responses reporting their use of the internet for community purposes were coded as eight dichotomous indicators that were treated as an additional scale. PCA with polychoric correlation yielded an initial two-component solution that accounted for 47.46% and 21.17% of the total variance, respectively. As expected, oblimin rotation revealed the two components representing both classrooms and schools as contexts of online community building to be correlated ( $r=0.33$ ). Since the eight-item scale showed a high level of internal consistency with a Cronbach’s  $\alpha$  of 0.842, the impossibility of distinguishing between classroom and school face-to-face community building led us to focus on the complete scale as a single measure of teachers’ use of the internet for community purposes. A one-component solution was accordingly retained for parsimony (KMO=0.745 and a significant Bartlett’s test,  $p=0.000$ ) with component loadings for all eight items ranging from 0.503 to 0.844.

### 3.4. Analysis

To accomplish the objectives of this research, we started out with descriptive and bivariate analyses of the selected measures. Appropriate measures of asso-



ciation and corresponding significance tests were calculated depending on the level of measurement: Pearson's  $r$  was used between pairs of continuous variables; Spearman's rho ( $r_s$ ) was used between ordinals and pairs formed by quantitative and ordinal variables; point-biserial correlation ( $r_{pb}$ ) was calculated between quantitative and dichotomous variables; and phi ( $r_\phi$ ) served to test correlations between dichotomous and pairs formed by ordinal and dichotomous variables. A multivariate regression was then developed to examine the factors involved in teachers' use of the internet for community purposes, testing for separate effects, and controlling for the other variables included in the models.

Accordingly, four sets of variables were specified and a step-by-step procedure was carried out through hierarchical multiple regression (Cohen et al., 2003). First, school characteristics included the specific school attributes from which the sample for the study was built, including the education level offered, the school's type of funding, and its location. Age, gender, and teachers' frequency of internet access at home were incorporated as socio-demographic characteristics from which their effect on online community building could also be controlled. The main effects model tested in this research was then specified by the addition of face-to-face community building and digital literacy. Lastly, in the fourth step, a linear-by-linear interaction between the two latter factors was computed and added to specify the full effects model, within which a conditional relationship between online and face-to-face community building on the different levels of teachers' digital literacy was examined.

Using hierarchical regression, the ability to improve the explained variance in teachers' use of the internet for community purposes was computed for each four sets of independent variables, step by step, over and above that explained by previous sets.  $R$ -squared ( $R^2$ ) was computed as a measure of the total amount of variance explained collectively by all the independent variables included in each model.  $F$ -tests were used to determine the significant contribution of each step to the explanation reflected in  $R^2$  increments. Regression coefficients (B), standard errors (SE),  $t$ -tests of significance, and the corresponding standardised versions (Beta) were also computed, the latter serving as a measure of the relative importance of any variable considered in each model.

Ordinal and dichotomous independent variables were dummy coded, and both face-to-face community building and digital literacy were centred (i.e., the mean was subtracted from raw scores) to remove nonessential multicollinearity purely due to scaling. No significant violation of the major assumptions of regression modelling was observed. Alternative non-linear models were computed to test linearity and were discarded. Variance-inflation factors (VIF) did not show any evidence of multicollinearity among the variables included in the subsequent models, and multivariate normality was checked by inspecting the residuals.

Finally, in order to examine the interaction – that is, the conjoint effect of the predictors involved – a simple slope analysis was also carried out (Jaccard & Turrisi, 2003). Three points (i.e., mean, one standard deviation above, and one below) representing low, average, and high levels of digital literacy and face-to-

face community building were selected for this purpose. Intercept, simple slopes, standard errors, t-tests, and 95% confidence intervals were calculated for both. Regression lines for low, average, and high levels of digital literacy and face-to-face community building were also plotted for further examination.

Factor 9.20 (Lorenzo-Seva & Ferrando, 2006) was used for the PCA with polychoric correlation and reliability analysis, and SPSS 22 assisted the descriptive, bivariate, and multivariate analyses. A proper standardised solution was computed separately for the full effects models to replace the one provided by SPSS, as it incorrectly handles the product term modelling the interaction (Aiken & West, 1991). Interaction 1.7 (Soper, 2013) was used to analyse and plot the interaction in the final model.

**Table 1.** Mean, standard deviation, and correlations for the observed variables ( $n=2,163$ )

	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Online community building (1)	1.41	1.63	-								
Face-to-face community building (2)	5.03	2.04	0.29 <sup>c</sup>	-							
Digital literacy (3)	3.92	2.01	0.35 <sup>c</sup>	0.08 <sup>c</sup>	-						
Education level <sup>d</sup> (4)	1.04	0.96	-0.01	-0.27 <sup>c</sup>	0.12 <sup>c</sup>	-					
School's type of funding <sup>e</sup> (5)	0.40	0.49	-0.05 <sup>a</sup>	-0.01	-0.01	0.08	-				
Town population <sup>f</sup> (6)	1.63	0.96	-0.08 <sup>c</sup>	-0.12 <sup>c</sup>	-0.02	0.16 <sup>c</sup>	0.36 <sup>c</sup>	-			
Age <sup>g</sup> (7)	1.00	0.55	-0.07 <sup>b</sup>	0.07 <sup>b</sup>	-0.24 <sup>c</sup>	0.00	-0.01 <sup>c</sup>	0.08 <sup>c</sup>	-		
Gender <sup>h</sup> (8)	0.38	0.49	0.11 <sup>c</sup>	0.31 <sup>c</sup>	0.31 <sup>c</sup>	0.16 <sup>c</sup>	0.02	0.04	0.05 <sup>a</sup>	-	
Internet access at home <sup>i</sup> (9)	1.51	1.19	0.31 <sup>c</sup>	0.05 <sup>a</sup>	0.64 <sup>c</sup>	0.12 <sup>c</sup>	-0.04	0.04	-0.15 <sup>c</sup>	0.23 <sup>c</sup>	-

<sup>a</sup>  $p < 0.050$ ; <sup>b</sup>  $p < 0.001$ ; <sup>c</sup>  $p = 0.000$ .

<sup>d</sup> 0=Compulsory primary, 3=Vocational Education; <sup>e</sup> 0=Public, 1=Private; <sup>f</sup> 0=Less than 5,000, 3=500,001 or more; <sup>g</sup> 0=30 years old or younger, 2=51 years old or older; <sup>h</sup> 0=Female, 1=Male; <sup>i</sup> 0=Never or almost never, 3=Daily.

Source: authors' elaboration.

## 4. Findings

### 4.1. Descriptive and bivariate analyses

Table 1 shows that use of the internet for community purposes is not widespread among primary and secondary teachers. The sample mean of online community building is 1.41 (s.d.=1.63) on a scale ranging from zero to eight. In contrast, both face-to-face community building and digital literacy have higher observed means, with corresponding averages of 5.03 (s.d.=2.04) and 3.92 (s.d.=2.01) in two scales ranging from zero to ten and zero to seven, respectively. Our results suggest fairly digitally literate teaching staff, at least in terms of the mastery of basic internet skills, with face-to-face community practices being slightly more common in their daily activity in classrooms and schools.

Online community building appears to be less pervasive than the corresponding face-to-face community practices, and both also show an expected and statistically significant correlation ( $r=0.29$ ,  $p=0.000$ ). Digital literacy is also moderately correlated ( $r=0.35$ ,  $p=0.000$ ), suggesting that teachers' digital skills are an important predictor of their appropriation of the internet for community purposes. In turn, face-to-face community building is slightly correlated with digital literacy ( $r=0.08$ ,  $p=0.000$ ), but this association is too weak to be of practical significance. As a result, and coherently with the intuition that non-technology mediated practices do not increase or decrease digital literacy or vice versa, subsequent analyses of the interaction will consider them to be moderators rather than mediators (Frazier et al., 2004).

A mediation effect would require an association between face-to-face community building and digital literacy in order to be the explanatory mechanism of their relationship with the appropriation of the internet for community purposes. However, under the more plausible hypothesis of moderation, the effects are conditional, i.e., they alter or modify the direction or strength of the relationship without the need to be correlated (Baron & Kenny, 1986). As expected, teachers' digital literacy may act as a moderator, changing the relationship between face-to-face community building and the appropriation of the internet in classrooms and schools for the same purpose. The opposite may also hold true, i.e., face-to-face community building moderating the relation between digital literacy and online community building, as the interaction can be interpreted in both directions in non-causal studies.

Continuing with the bivariate exploration, columns 1 to 3 of Table 1 provide information on the relationship between these three measures and other independent variables considered in this research. Firstly, with regard to school characteristics, education level appears to be correlated with face-to-face community building ( $r_s=-0.27$ ,  $p=0.000$ ) and digital literacy ( $r_s=0.12$ ,  $p=0.000$ ) in an opposite direction. Type of school funding (i.e., public or private) does not show any substantial difference, and location of the school appears to be slightly and negatively associated with online ( $r_s=-0.08$ ,  $p=0.000$ ) and face-to-face ( $r_s=-0.12$ ,  $p=0.000$ ) community building. On the other hand, with regard

to socio-demographic characteristics, teachers' age is negatively correlated with digital literacy ( $r_s=-0.24$ ,  $p=0.000$ ), while a consistent gender effect in favour of male teachers is observed in relation to online community building ( $r_{pb}=0.11$ ,  $p=0.000$ ), face-to-face community building ( $r_{pb}=0.31$ ,  $p=0.000$ ), and digital literacy ( $r_{pb}=0.31$ ,  $p=0.000$ ). Lastly, it should also be noted that frequency of internet access at home is positively associated with the three measures, showing a stronger relationship with digital literacy ( $r_s=0.64$ ,  $p=0.000$ ) and online community building ( $r_s=0.31$ ,  $p=0.000$ ).

#### 4.2. Multivariate analysis

The left side of Table 2 shows the results for the first two regression models comprising school and socio-demographic variables that were controlled in the analysis of teachers' use of the internet for community purposes. Firstly, it should be noted that although the school characteristics model (1) is statistically significant ( $F=3.419$ ,  $p<0.001$ ), in the school and socio-demographic characteristics model (2) the  $R^2$  increases from 0.011 to 0.107 ( $F$  for the  $R^2$  change=37.280,  $p=0.000$ ). The second model is also statistically significant ( $F=19.238$ ,  $p=0.000$ ), and shows a significant negative effect of education level – which was not previously observed in the bivariate analysis – and location of school, both of which are consistent with the effects observed in the school characteristics model.

Compulsory secondary (Beta=-0.095,  $p=0.000$ ) and post-compulsory (Beta=-0.085,  $p<0.001$ ) teachers appear to use the internet for community purposes less than their counterparts in primary education. Moreover, teachers at schools located in less populated towns (e.g., of less than 5,000 inhabitants) seem to be more frequent users than their counterparts teaching in medium and large cities, with Beta coefficients ranging from -0.070 ( $p<0.050$ ) to -0.109 ( $p<0.010$ ). In both regression models, and according to the initial explorations in the bivariate analysis, the type of school funding is not statistically significant. In contrast, the socio-demographic characteristics introduced in the second regression model, such as gender and frequency of internet access at home, showed a significant and positive effect. Male teachers use internet for community purposes somewhat more frequently (Beta=0.056,  $p<0.010$ ), as do those who are more frequently connected compared with those who never or almost never use the internet at home (e.g., Beta=0.329,  $p=0.000$ , for daily users). These results are consistent with the exploratory analysis, but also show that the initial bivariate effect of age becomes non-significant in the subsequent multivariate regressions.

The right side of Table 2, starting with the main effects model (3), enables us to examine the effect of both face-to-face community building and digital literacy with the appropriate statistical control for school and socio-demographic characteristics. In terms of its overall fit, the third regression model is also statistically significant ( $F=36.553$ ,  $p=0.000$ ), with the  $R^2$  increasing to a more acceptable level of 0.207 ( $F$  for the  $R^2$  change=133.331,  $p=0.000$ ). Com-

Table 2. Hierarchical multiple regression of teachers' use of the internet for community purposes ( $n=2,163$ )

	School characteristics model (1)			School and socio-demographic characteristics model (2)			Main effects model (3)			Full effects model (4)		
	B (SE)	Beta	t	B (SE)	Beta	t	B (SE)	Beta	t	B (SE)	Beta	t
Intercept	1.788 (0.102)	-	17.473 <sup>d</sup>	1.246 (0.136)	-	9.189 <sup>d</sup>	1.438 (0.131)	-	10.987 <sup>d</sup>	1.435 (0.130)	-	11.050 <sup>d</sup>
<b>Education level</b>												
Compulsory primary	-	-	-	-	-	-	-	-	-	-	-	-
Compulsory secondary	-0.210 (0.090)	-0.059	-2.328 <sup>a</sup>	-0.337 (0.087)	-0.095	-3.876 <sup>d</sup>	-0.077 (0.084)	-0.022	-0.906	-0.084 (0.084)	-0.039	-1.007
Post-Compulsory	-0.126 (0.095)	-0.033	-1.317	-0.321 (0.093)	-0.085	-3.470 <sup>c</sup>	-0.067 (0.090)	-0.018	-0.747	-0.075 (0.089)	-0.032	-0.834
Vocational Education	0.015 (0.141)	0.003	0.109	-0.129 (0.136)	-0.021	-0.948	0.086 (0.130)	0.014	0.664	0.088 (0.129)	0.024	0.685
<b>School's type of funding</b>												
Public	-	-	-	-	-	-	-	-	-	-	-	-
Private	-0.074 (0.079)	-0.022	0.933	-0.022 (0.077)	-0.006	-0.284	0.001 (0.072)	0.000	0.020	0.000 (0.072)	0.000	-0.009
<b>Town population</b>												
Less than 5,000	-	-	-	-	-	-	-	-	-	-	-	-
5,000 – 50,000	-0.190 (0.124)	-0.055	-1.535	-0.242 (0.118)	-0.070	-2.043 <sup>a</sup>	-0.217 (0.112)	-0.063	-1.946 <sup>a</sup>	-0.218 (0.111)	-0.103	-1.966 <sup>a</sup>
50,001 – 500,000	-0.338 (0.128)	-0.096	-2.644 <sup>b</sup>	-0.386 (0.123)	-0.109	-3.149 <sup>b</sup>	-0.310 (0.116)	-0.088	-2.680 <sup>b</sup>	-0.302 (0.115)	-0.140	-2.636 <sup>b</sup>
500,001 or more	-0.327 (0.140)	-0.082	-2.343 <sup>a</sup>	-0.389 (0.135)	-0.097	-2.891 <sup>b</sup>	-0.217 (0.127)	-0.068	-2.132 <sup>a</sup>	-0.256 (0.126)	-0.106	-2.035 <sup>a</sup>
<b>Age</b>												
30 years old or younger	-	-	-	-	-	-	-	-	-	-	-	-
31 – 50 years old	0.096 (0.100)	0.027	0.960	0.071 (0.095)	0.020	0.749	0.048 (0.095)	0.022	0.505			
51 years old or older	-0.113 (0.128)	-0.025	-0.885	0.000 (0.124)	0.000	-0.007	-0.032 (0.123)	-0.011	-0.258			
<b>Gender</b>												
Female	-	-	-	-	-	-	-	-	-	-	-	-
Male	0.187 (0.073)	0.056	2.578 <sup>b</sup>	0.077 (0.071)	0.023	1.087	0.077 (0.070)	0.038	1.102			

Table 2 (continued)

	School characteristics model (1)		School and socio-demographic characteristics model (2)		Main effects model (3)		Full effects model (4)	
	B (SE)	Beta t	B (SE)	Beta t	B (SE)	Beta t	B (SE)	Beta t
<b>Internet access at home</b>								
Never or almost never								
Monthly			0.291 (0.116)	0.058 2.515 <sup>a</sup>	0.012 (0.113)	0.002 0.110	0.030 (0.112)	0.010 0.269
Weekly			0.615 (0.088)	0.172 7.005 <sup>d</sup>	0.113 (0.094)	0.032 1.194	0.133 (0.094)	0.061 1.424
Daily			1.226 (0.094)	0.329 13.099 <sup>d</sup>	0.501 (0.110)	0.135 4.562 <sup>d</sup>	0.503 (0.109)	0.222 4.619 <sup>d</sup>
<b>Face-to-face community building</b>								
Digital literacy					0.206 (0.017)	0.255 12.215 <sup>d</sup>	0.207 (0.017)	0.421 12.357 <sup>d</sup>
Interaction					0.207 (0.022)	0.254 9.354 <sup>d</sup>	0.211 (0.022)	0.423 9.608 <sup>d</sup>
							0.045 (0.008)	0.185 5.859 <sup>d</sup>
<b>Model summary</b>								
R <sup>2</sup> (Adjusted R <sup>2</sup> )		0.011 (0.008)		0.107 (0.101)		0.207 (0.202)		0.220 (0.214)
F for the model		3.419 <sup>c</sup>		19.238 <sup>d</sup>		36.553 <sup>d</sup>		36.959 <sup>d</sup>
R <sup>2</sup> change		0.011		0.095		0.101		0.013
F for change in R <sup>2</sup>		3.419 <sup>c</sup>		37.280 <sup>d</sup>		133.331 <sup>d</sup>		34.330 <sup>d</sup>

<sup>a</sup>  $p < 0.050$ ; <sup>b</sup>  $p < 0.010$ ; <sup>c</sup>  $p < 0.001$ ; <sup>d</sup>  $p = 0.000$ .

Source: authors' elaboration.

pared to the previous model, there is still a slightly negative effect of the location of the school in favour of teachers in less populated towns, with Beta coefficients ranging from  $-0.063$  ( $p < 0.050$ ) to  $-0.088$  ( $p < 0.010$ ). However, the effect of the education level of the school and the teachers' gender become statistically non-significant as the hierarchical regression evolves towards the main effects model and beyond. Additionally, the influence of the frequency of internet access at home also declines, showing only a statistically significant difference between daily users and those that are never or almost never connected (Beta=0.135,  $p=0.000$ ).

Interestingly, the inclusion of face-to-face community building (Beta = 0.255,  $p=0.000$ ) and digital literacy (Beta=0.254,  $p=0.000$ ) shows an expected and positive effect after controlling for school and socio-demographic characteristics. Being more involved in face-to-face community building and having a higher level of digital literacy are indeed the strongest predictors among the variables included in the main effects model, showing an independent and reasonably comparable effect on the appropriation of the internet for community purposes, which ultimately contributes to a significant increase in the total explained variance. However, the aim of this study is to broaden our knowledge of the eventual interaction between both predictors, considering their role as moderators in the final regression model.

In the last column of Table 2, the full effects model (4) is the final step of the hierarchical procedure carried out in this study. The overall adjustment of the final model is acceptable ( $F=36.959$ ,  $p=0.000$ ) and implies a moderate but statistically significant change with respect to the previous model ( $F$  for the  $R^2$  change=34.330,  $p=0.000$ ) that slightly improves the  $R^2$  to a value of 0.220. After examining the regression coefficients, location of school and, marginally, frequency of internet access at home are the only lasting significant effects out of the school and socio-demographic characteristics included as statistical controls. Beta coefficients range from  $-0.103$  ( $p < 0.050$ ) to  $-0.140$  ( $p < 0.010$ ) in favour of schools located in small towns with less than 5,000 inhabitants. In turn, the effect of the frequency of access at home is only present for the most frequently connected teachers (i.e., daily users, with Beta=0.222,  $p=0.000$ ). No other control variables appear to contribute significantly to the explanation of the variability in teachers' use of the internet for community purposes in classrooms and schools.

With regard to interpreting the coefficients of the variables involved in the interaction, it is important to note that multiple regressions with interactions require careful consideration. As opposed to the main effects model, the effect of the predictors is modelled by incorporating the first order and the corresponding second order terms that carry the interaction in the equation. Here, first order terms (i.e., face-to-face community building and digital literacy) represent simple effects compared to their effects in the main effects model, that is, their conditional effects once the joint influence of both predictors has been statistically controlled. Specifically, the associated coefficients represent their relative contribution to the regression model when the value of the moderator variable involved in

the interaction equals zero. Since the measures were mean centred for the regression analysis, it is safe to interpret them as the particular influence of the independent variable at the sample mean of the moderator variable. The interaction term, in turn, carries the remaining combined effect of both predictors, and represents the change in the slope of the regression on the independent variable given a unit increment in the moderator variable.

Hence, the conditional effects of face-to-face community building (Beta=0.421,  $p=0.000$ ) and digital literacy (Beta=0.423,  $p=0.000$ ) are both statistically significant, as is the case for their interaction (0.185,  $p=0.000$ ). In the specific case of teachers with average digital skills, being more involved in face-to-face community building contributes positively to the appropriation of the internet for community purposes. The opposite is also true, as having a higher level of digital literacy – in the case of teachers with average involvement in face-to-face community building – is associated with more frequent use of the internet for the same purpose. In other words, both predictors have an independent, positive, and nearly comparable effect on the unequal appropriation of the internet for community purposes among primary and secondary teachers. Similarly, once the corresponding conditional effects have been taken into account, the non-zero interaction between both predictors reveals a potentially interesting conjoint effect that is worth examining in detail.

These results confirm and expand on the initial conclusions of the main effects model, and allow us finally to accept the full effects model computed in the last step as the best explanation for our data. Indeed, the overall adjustment of the final model suggests that the improvement associated with the inclusion of the interaction – only a 0.013 increase in the  $R^2$  – is statistically significant but relatively small. However, what is relevant for analytical purposes is not the mere size of the interaction effect but its practical significance (see Champoux & Peters, 1987, for a discussion). In fact, the increase in  $R^2$  is viewed as an incomplete measure of the strength of the moderator effects, and alternative methods have been suggested for post hoc probing. Accordingly, an additional simple slope analysis was carried out to interpret the contribution of each predictor at three particular points representing low (-1 s.d.), average (mean), and high (+1 s.d.) levels in the moderator involved in the interaction. Table 3 provides the statistical details, and Figure 1 serves as a graphical representation to assist in interpreting these results.

The first row in Table 3 shows the relationship between face-to-face and online community building by taking into account the moderating role of digital literacy. Accordingly, three simple slopes were computed to measure the conditional effect of face-to-face community building at low, average, and high levels of digital literacy. Three independent regression lines have also been plotted on the left of Figure 1. An analysis of the interaction reveals a decreasing contribution of face-to-face community building as the levels of the moderator variable increase. As expected, teachers with lower ( $B=0.376$ ,  $p<0.010$ ) and medium ( $B=0.207$ ,  $p<0.050$ ) levels of digital literacy benefited from an increase in their involvement in face-to-face community building. Interest-

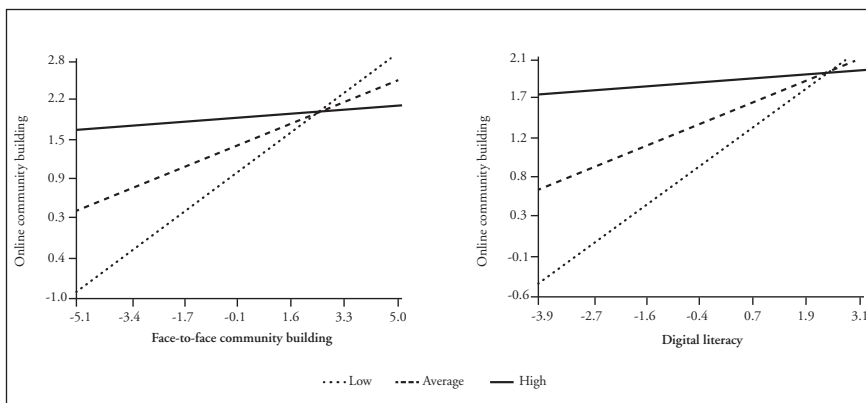


**Table 3.** Simple slopes analysis of the interaction between face-to-face community building and digital literacy ( $n=2,163$ )

Moderator level	Intercept	Simple slope	Standard error	t	95% CI around the simple slope
<b>Digital literacy</b>					
Low (-1 s.d.)	1.010	0.376	0.165	2.281 <sup>b</sup>	0.053 to 0.700
Average (Mean)	1.435	0.207	0.017	12.357 <sup>a</sup>	0.174 to 0.240
High (+1 s.d.)	1.860	0.037	0.173	0.216	-0.302 to 0.377
<b>Face-to-face community building</b>					
Low (-1 s.d.)	1.015	0.382	0.172	2.224 <sup>b</sup>	0.045 to 0.720
Average (Mean)	1.435	0.211	0.022	9.610 <sup>a</sup>	0.168 to 0.254
High (+1 s.d.)	1.855	0.040	0.171	0.234	-0.295 to 0.375
<b>Model power analysis</b>					
$R^2$ change				0.013	
Cohen's $f^2$				0.282	
Beta (type II error rate)				0.000	
Observed power				1.000	

<sup>a</sup>  $p < 0.050$ ; <sup>b</sup>  $p < 0.010$ .

Source: authors' elaboration.



**Figure 1.** Graphical representation of the interaction between face-to-face community building and digital literacy ( $n=2,163$ ).

Source: authors' elaboration.

ingly, this effect is not observed among the most digitally literate teachers ( $B=0.037, p > 0.050$ ). Being more involved in face-to-face community building is not statistically associated with an increase in their already higher use of the internet for the same purpose.

Conversely, the second row in Table 3 presents the simple slope analysis for the moderating role of face-to-face community building and depicts the other side of the same conditional effect. The right side of Figure 1 presents the three corresponding regression lines at the different levels of face-to-face community building as the moderator variable. The decreasing association between digital literacy and online community building shows that teachers with lower ( $B=0.382, p<0.010$ ) and middle ( $B=0.211, p<0.050$ ) involvement in face-to-face community building benefited from the improvement in their digital skills. Accordingly, the effect of digital literacy on the appropriation of the internet for community purposes weakens as face-to-face community building increases, and shows no significant gain among those who are most involved in face-to-face community building ( $B=0.040, p>0.050$ ). Analogous to the previous slope analysis, the acquisition of higher-level internet skills is not statistically associated (here, among those who are most involved in face-to-face community building) with an increase in their already higher use of the internet for community purposes.

## 5. Discussion

The use of a digital inequality approach recognises the importance of adopting a multidimensional perspective to study how teaching and professional practices are shaped through the progressive incorporation of ICT in primary and secondary schools. In this regard, this study analysed the introduction of the internet into teachers' everyday activity in order to support and enhance community building in classrooms and schools, examining its relationship with the corresponding face-to-face community practices, and addressing the role that digital literacy plays in this relationship. As has been discussed earlier, this is a challenging area in which the specific opportunities to foster and support social interaction and community involvement in classrooms and schools have not been adequately addressed. Providing a comprehensive and unified view, our findings reveal a complex process of appropriation of the internet among primary and secondary teachers that suggests that online community building appears to be supplementing or extending – but not revolutionising – their face-to-face teaching and professional practices.

Contrary to the digital divide approach, school and socio-demographic characteristics do not provide an adequate explanation of the appropriation of the internet for community purposes. Bivariate analyses of school characteristics show that teachers at public schools and schools located in less populated towns appear to use the internet for community purposes more than their counterparts. Similar effects are observed in relation to socio-demographic characteristics included in this study, where young, male, and more frequent users of the internet at home also appear to use the internet more for the same purpose. These differences, however, become non-significant after the inclusion of face-to-face community building and digital literacy in the multivariate analysis. In fact, male teachers at schools located in less populated towns

appear to be more involved in face-to-face community building. Similarly, young, male, and more frequent users of the internet at home also appear to have higher levels of digital literacy.

Accordingly, face-to-face community building and digital literacy account for most of the school and socio-demographic differences observed in teachers' appropriation of the internet for community purposes. In this regard, after controlling for these differences, an inspection of the relationship with the corresponding non-technology mediated practices shows that teachers who were more involved in face-to-face community building used the internet more for the same purpose. These findings are coherent with previous research on online community building in classrooms and schools. In particular, they expand on the findings of Schuck (2003), Carmichael and Procter (2006), and Matzat (2010), who studied different modes of teachers' online and face-to-face interaction and collaboration in schools. Rather than transforming relational practices, the internet appears to be progressively embedded into teachers' everyday activity as a complementary means to extending face-to-face practices and supporting more traditional approaches to community building in classrooms and schools. Likewise, more internet-savvy teachers used the internet more for community purposes, thus illustrating the importance of also taking into account digital literacy as a key factor of internet appropriation to support social interaction and community involvement.

Furthermore, our results highlight the need to take into consideration the interaction between the above factors. Considering the moderating role of digital literacy, at least in terms of the mastery of basic internet skills, we have shown that the relationship between face-to-face community building and online community building decreases as the levels of digital literacy increase. The same effects are observed on the opposite side of the interaction, where the moderating role of face-to-face community building is taken into account. Hence, reporting higher levels of involvement in face-to-face community building or digital literacy effectively helped promote teachers' use of the internet to increase their opportunities for communicating and collaborating in classrooms and schools. However, it did not necessarily increase the already higher use of the internet for community purposes among the most internet-savvy teachers or those most involved in face-to-face community building, respectively.

Caution should be exercised in interpreting our findings given the cross-sectional nature of this study. Based on data collected from a national sample, but only at one specific point in time, our results are statistically representative for primary and secondary teachers in Catalonia at the time of the study but should not be taken as any causal judgment about the relationship between face-to-face community building and the appropriation of the internet in classrooms and schools for the same purpose. It is also important to note that our findings need to be interpreted not only in the local but also in the temporal context in which the research was conducted. Present and future developments of ICT, and particularly the internet, may offer new opportunities for fostering and supporting communication, collaboration, and exchange that

are yet to be fully exploited in schools. However, the process of educational innovation is not just a consequence of following technological trends, but rather involves the incorporation of genuine benefits into the processes of schooling. As has been discussed earlier, this is a challenge that educational systems do not always successfully meet and hence requires further investigation.

Comparative and longitudinal studies need to be carried out to broaden our knowledge of the observed patterns and continue investigating the factors involved in the unequal appropriation of the internet for social interaction and community involvement among primary and secondary teachers. In this regard, it would be reasonable to expect similar results were the study conducted today. As has been discussed from an historical perspective on media and its educational impact (see, for example, Cuban, 1986; Cohen, 1987; and Saettler, 1990, regarding previous media innovation such as film, radio, television, or the computer), technology innovation has never, on its own, led to educational innovation. Consequently, changes in daily activity in classrooms and schools are much slower and less extensive than has been expected (Reiser, 2001). Further studies will be necessary to examine the evolution of such changes and, particularly, continue addressing the relationship between technology and non-technology mediated practices.

## 6. Conclusion

As the internet is incorporated in schools, this research has explored the extent to which primary and secondary teachers have shaped their teaching and professional practices through its appropriation for community purposes. After all, the existence of a divide between those who have access to or use the internet is not the main issue. What really matters are the specific patterns of use by which the internet functions as a legitimate tool for social interaction and community involvement in meaningful contexts of everyday life. Far from utopian or dystopian views of technology, our results do not support the deterministic logic implicit in the effects – be they positive or negative – that ICT have been expected to lead to. On the contrary, the introduction of the internet into the Catalan education system does not appear to be revolutionising teachers' community-oriented practices. As has been discussed before, it is more appropriate to state that the internet appears to be progressively embedded in teachers' everyday activity as a complementary means to extending their face-to-face practices and supporting community building in classroom and schools.

Taking into consideration the introduction of ICT in schools as an opportunity to extend face-to-face community practices may help direct individual, organisational, and governmental efforts toward the careful consideration of the educational reasons why the internet has been introduced in the heart of the schooling processes. As we have discussed elsewhere (Meneses & Mominó, 2012), there is a long tradition in the field of school effectiveness and school improvement that links social and community aspects to educa-

tional success. Whether in the dynamics of the classroom, in the way schools organise their functioning, or in the opening up of these two contexts of everyday activity to the local community, it is through the creation of new and better opportunities for teamwork, participation, and joint responsibility that we can find some principles for ICT integration in schools that may not only be driven towards efficiency but also by a desire for genuine improvement of the processes of schooling.

These opportunities, however, should not be taken for granted as the educational applications of technology evolve. After providing access to the necessary equipment, further efforts are required to support the process of incorporating ICT – and particularly the internet – in classrooms and schools. Although the benefits of promoting an adequate level of digital skills has been widely recognised among education researchers, our results also highlight the need to encourage agreement between teachers, school administrators, and policy makers on the importance of a community approach to achieving educational goals. That is, a community agreement that recognises the value of communication and collaboration as successful means of addressing the educational challenges of schooling. Only then, going beyond the technological promise, will we be able to empower education systems to create the conditions that support the effective incorporation of the internet as a complementary tool to support and enhance community building in classrooms and schools.

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