

# Cognitive communication 2.0 in Higher Education: to tweet or not to tweet?

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**Abstract:** Research has been fertile in producing studies on pedagogical change and innovation through technology in Higher Education Institutions, namely the integration of the social media in pedagogical practice. However, there is a lack of studies on the integration of the social media in the particular field of lectures. In this context, commonly practiced, the teacher faces a wide audience and feels the need to activate mechanisms of direct instruction, for reasons of economy of time and because it is the most dominant pedagogical model. As a result there is a communication paradigm 1.0 (one-way communication, one-to-many, low or non-existent interaction). In this study, exploratory and quantitative in nature, an approach to the thematic of the exploration of the social media in order to upgrade the cognitive communication from 1.0 to 2.0 (many-to-many, interaction between all the participants) in lectures was made. On the approach to the problem, we explored a PowerPoint presentation with the integration of the micro blogging tool Twitter, as a basis for addressing the characteristics of cognitive communication 2.0. For data collection a questionnaire was designed, based on literature, and intended to evaluate several dimensions of the resource used, namely: i) pedagogical issues, ii) technological aspects, iii) cognitive learning; iv) interactions in the classroom; v) positive behavior in the classroom and vi) negative behaviour in the classroom. The results indicate that students recognize the potential of this tool in the dimensions assessed. Twitter integration in PowerPoint allowed the teacher and the students to read each other's views and each had the opportunity to contribute to the debate. It also allowed the release of multiple choice questions to the audience, with answers via Twitter and projection of results via PowerPoint. This way, a true cognitive communication 2.0 took place.

**Keywords:** classroom; cognitive communication; learning; micro blogging; Twitter; web 2.0

## 1. Introduction

The new forms of communication are inextricably linked to the imposition of new forms of teaching and learning, which have resulted in the redefinition of political and pedagogical models. In this context of profound social changes imposed by the increasingly presence and transformative nature of technology, the Higher Education Institutions (HEIs) are confronted with new challenges which require their reorganization so that they can respond effectively.

Information Technologies (IT), specially the “web phenomena”, have contributed to changing the way people work together, share resources, co-produce, co-act and get involved in activities that benefit all (Fuchs et al., 2010). Nowadays, expressions such as “collaborative learning”, “learning communities”, “media in education”, “social media” and other similar ones, are essential in educational investigation. However, research on these topics focuses on online environments or face-to-face groups of limited size. Studies in which these principles are applied to a classroom with dozens of students are rare.

In fact, research shows that the classroom has been losing its historic centrality in favour of new agglutinating poles such as the Personal Learning Environment (PLE) and the Social Learning Network (SLN), usually associated with spaces outside the classroom – Cloud Learning Environment. However, despite the development of on-line learning systems and b-learning, classroom learning is still largely dominant, and the organization of activities continues to have the classroom learning as

the nucleus. Hence the importance of designing activities and creating resources that, in conjunction with this new paradigm, promote the exploration of the potential of the new ways of learning that dominate the Cloud Learning Environment.

This paper aims to contribute to the study of the issues related with the cognitive communication morphology in classroom lectures, in Higher Education, where often the communication is done from one-to-many. This study takes an exploratory nature, since the bibliographic review has revealed a lack of studies about the exploitation of the social media, as a means of enhancing cognitive communication 2.0 in the specific context of lectures to large groups. So, taking an approach to this issue and helping to open a new field of study are also the goals of this study. To do so we started with a PowerPoint presentation with the integration of micro blogging tool Twitter, as a basis for addressing the characteristics of communication 2.0 in classroom in lectures of a more expository nature.

The methodology of data collection used was a questionnaire built based on literature review, with which we intended to assess various dimensions of the resource used in classroom lectures and to verify if the integration of Twitter in the presentation contributes to the upgrading of a cognitive communication 1.0 (one-way communication, one-to-many, low or non-existent interaction) to cognitive communication 2.0 (many-to-many, interaction between all the participants). This study has a quantitative approach, since the data of the questionnaire was processed using the basic procedures of descriptive statistics. The results of this study are preliminary and intended to serve as an exploratory approach to the subject.

## 2. Related work: change challenges and pedagogical innovation in institutions of higher education through technology

Throughout this study, we employ the expressions "cognitive communication 1.0 and 2.0" as an analogy to the rupture in the paradigm of web 1.0 to 2.0, proposed by O'Reilly (2005). In web 1.0, users are limited to passive viewing of content others have created. In contrast, web 2.0 is a space for interaction, dialogue and collaboration, where users assume the role of not only consumers but also producers (*prosumers*) of content.

Figures 1-3 represent lectures at universities at three times in history: in Figure 1 a picture of the 13<sup>th</sup> century is reproduced, which shows Henry of Germany delivering a lecture to university students in Bologna (Voltolina, 1233); figure 2 depicts the influential British scientist Michael Faraday in the nineteenth century, delivering a Christmas lecture at the Royal Institution (Blaikley, ca1856); figure 3 (uniinnbruck, 2008) depicts a lecture today. What emerges from the analysis of the images is the immutability of the communication process in lectures: a masterful communication, in which the teacher exposes the contents to a wide audience of students. In fact, communication 1.0 in lectures has perpetuated throughout time. The communication upgrade from 1.0 to 2.0 is something that has not yet been materialized.

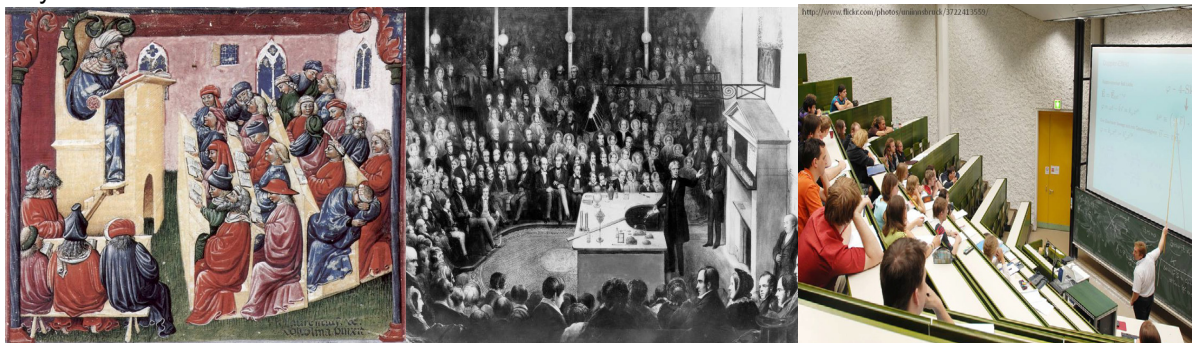


Figure 1: 13<sup>th</sup> century lecture

Figure 2: 19<sup>th</sup> century lecture

Figure 3: Nowadays lecture

Therefore, although the current lines of investigation are based on a more constructivist approach, the model where students are physically present, especially in lectures in HEIs is still organized in the same traditional way, of a more behavioral and cognitive type, which favours syllabus content and several teaching strategies in order to promote student learning (Miranda, 2009). A. D. Figueiredo (2009) states that the HEIs face-to-face model is also the most traditional one and, in essence, it is

based on four functions: i) transmission of content provided by lectures, often masterful, ii) application of concepts, iii) group work and iv) evaluation. These functions are shown in table 1.

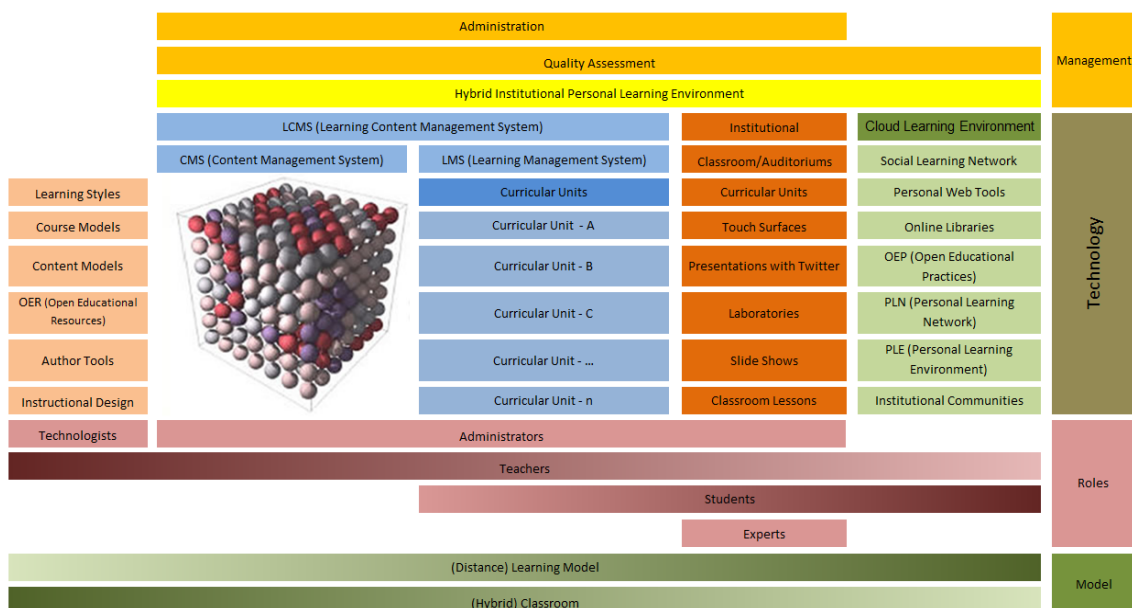
**Table 1:** Pedagogical face-to-face dominant model in the HEIs (Figueiredo, 2009)

Pedagogical face-to-face model	
Transmission of content	Lectures
Application of concepts	Lectures Lectures and practical lessons
Group work	Practical lessons Laboratories Projects
Evaluation	Tests/exams Projects Essays and Presentations

This way, it can be proven that the lectures are a central aspect in the way the teaching activity is organized in HEIs. 1.0 communication of lectures collides with the new ways of communicating and interacting in a society immersed in technology that is intrinsically linked to the imposition of new ways of teaching and learning, which results in the redefinition of political and pedagogical models. Social and economic factors call for the use of technology as pedagogical support. Mark Prensky (2001) was the first to use the term "digital natives", which is associated with expressions such as "residents", "Generation Y" or "Net Generation". These students grow up in environments immersed in technology and have different preferences and skills in key areas related to education, particularly in making use of the immense potential of web 2.0 (Castañeda & Soto, 2010; Kennedy et al., 2009), especially social software tools (blogs, micro blogs, sites of video sharing, social media, wikis or podcasts), which facilitate not only the emergence of communities of users, but also the involvement in social media.

The "Horizon Report: 2012 Edition Higher Education" (Johnson, Adams, & Cummins, 2012) makes a prospective analysis of the integration of technologies in HEIs, highlighting the need for fundamental change in fields such as: i) the architecture of training models: "Education paradigms are shifting to include online learning, hybrid learning and collaborative models. Budget cuts have forced Institutions to re-evaluate their education strategies" (p. 4-5), ii) the educators' role: "The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators" (p. 4) or iii) Adequacy of pedagogical activity in the HEIs to how people communicate, learn and work in modern societies; "The world of work is increasingly collaborative, driving changes in the way student projects are structured. Because employers value collaboration as a critical skill, silos both in the workplace and at school, are being abandoned in favour of collective intelligence" (p. 4).

In the current scenario, it matters that HEIs reconcile their conception of the educational process with new ways of learning and student expectations. The HEIs should not overlook the fact that IT offers the students the opportunity to control and manage their own learning beyond the institutional vision. The globalization of the sources of knowledge, that brings the world to the school and the growing importance of social media and collaborative work of smart mobs (Tapscott & Williams, 2008) emphasize the value of the Social Learning Network (SLN), which creates the need for the HEIs to evolve to a Hybrid Institutional Personal Learning Environment (HIPLÉ) architecture, as a bridge between the vision of the institution and the Personal Learning Environment (PLE) of the student. In Figure 4 a possible architecture for the integration of IT in cognitive communication is shown, in which there is a link between the student's PLE and the institutional vision, hence the resulting HIPLÉ. The Personal Learning Environment (PLE) of the student consists of the exploration of a multiplicity of skills available in the Cloud Learning Environment, which may go beyond the institutional vision. In fact, learning takes place increasingly through the social media, communities, institutions, exploring web tools, libraries of digital resources, repositories of Learning Objects, among other environments, tools and resources, which together result in the construction of the student's PLE outside the HEIs.



**Figure 4:** Hybrid Institutional Personal Learning Environment (HIPLE)

Despite the characteristics of this new generation of students, we cannot assume that all who reach higher education already possess the necessary skills to use web 2.0 technologies such as learning tools (Castañeda & Soto, 2010). On the other hand, it is also observed that the HEIs are still inadequately prepared to work with students who have completely different technical skills and learning preferences (Bennett, Maton, & Kevin, 2008).

To address this complex situation, the HEIs must create programmes and define methodologies that enhance the use of the enormous educational potential of web 2.0. Thus, it is expected that students will develop learning skills in this context and increase their motivation and, as a result, will increase the chances of achieving good academic results.

The introduction of technology in the facilitation of cognitive function in education means a challenge for applied research with very complex and slow progress. Among the changes that have been introduced in training models under e-learning, b-learning and face-to-face, it is in the latter where the pace of change is slower. Therefore, the classroom continues to be a place of excellence in the communication of knowledge. In this context, highly practiced, it is pertinent to introduce mechanisms of interaction mediated by technology, since research shows a significant correlation between the use of technology and time spent with social media and students engagement (Chen P., 2010; Junco, Heiberger, & Loken, 2010). In this line, the Horizon Report: 2012 Edition Higher Education, states that: "There is a new emphasis in the classroom on more challenge-based and active learning (...). The active learning approaches are decidedly more student-centered, allowing them to take control of how they engage with the subject and to brainstorm and implement solutions" (Johnson et al., 2012, p. 5).

In this study we focus on the institutional context, particularly in the lectures, where teachers are faced with numerous students and have the need to activate mechanisms of direct instruction, either to save time, or because this is the teaching model that they are comfortable with. Electronic presentations as a way to transmit knowledge are a means commonly used in these classes (James, Burke, & Hutchins, 2006). This is a reusable resource, a facilitator of discourse organization and an integrator of multiple media which can serve different learning styles, as well as becoming a stepping stone of motivation and it is also conducive to note taking by students.

These presentations are massively materialized on technologies such as PowerPoint and Prezi which have mechanisms to support text, video, image, flash animation and sound, but they also have the ability to interact with the so-called web 2.0 systems, such as the micro blogs. A PowerPoint or a Prezi presentation can therefore be linked with the micro blogging application Twitter, allowing the teacher the opportunity to speak to his students.

Recent research about the use of Twitter in academic work shows that although 85 % of undergraduates have a Facebook account, teachers prefer to integrate Twitter into the process of teaching and learning (Junco et al., 2010). In the category of micro blogs, Twitter, designed in 2006 by Jack Dorsey, allows users to share messages up to 140 characters. This system also allows sending messages to a direct channel specifically created to exchange information (# hashtags) and the vote for alternative options which are placed under review (by vote tweet @ x key\_word).

Individual or business initiatives (Elliot, 2011) have developed ADD-INS for Prezi and PowerPoint, allowing the following dynamics for those who have a Twitter account (teachers and students):

- Creation of a channel (not compulsory) for comments on the presentation that is being made;
- Students can comment directly on Twitter what they see and listen in the classroom as well as what they read from sharing with peers (virtual classroom);
- The teacher may have prepared additional comments for each slide, that hidden in "notes", can be sent to Twitter whenever it is projected;
- The teacher can capture and project in all, or in some of the screens, what is being shared on Twitter;
- The teacher can ask multiple-choice questions that are answered on Twitter, and the percentages of the responses for each option can be projected in a slide.

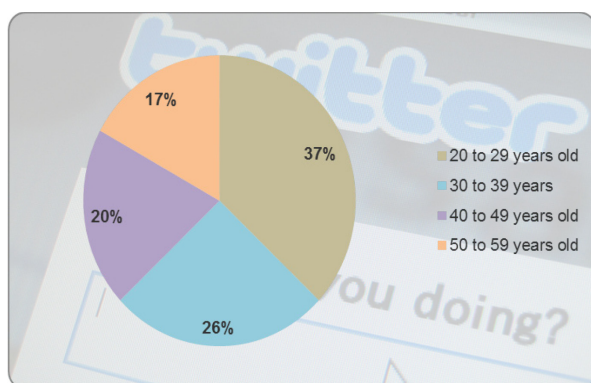
This model of communication in the classroom will increase the level of participation by: i) providing voice and turn to all the students, ii) facilitating and asking for the participation of more reserved students in oral participation iii) engaging the learning community in discussions about the theme and iv) exploring the acuity of young people to use IT.

### 3. Evaluation methodology

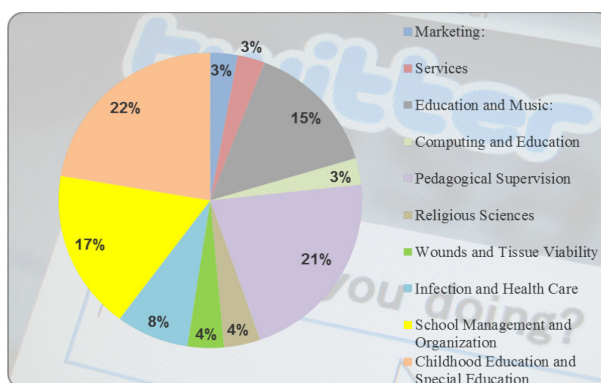
In the previous chapter some studies on the use of the social media for pedagogical purposes in various social contexts of the educational process, apart from lectures, were reported. However, as already mentioned, the literature reveals a lack of studies on the theme of exploitation of the social media to foster cognitive communication 2.0 in the context of lectures to large groups in higher education. Thus, this study assumes the characteristics of an exploratory study.

Considering, therefore, the nature of the study we did not seek to establish correlations between variables, but only to identify trends. It is expected that the results obtained will contribute to the articulation of web 2.0 tools with traditional cognitive communication in the classroom, in such a manner that positive impacts will result in pedagogical and technological effectiveness and thus in students learning achievements.

As a methodological approach to the problematic of the morphology of cognitive communication 2.0 in the context of the classroom, we used a PowerPoint presentation with the integration of Twitter. The exploitation of this resource was made during lectures to several masters classes, at the Portuguese Catholic University – Regional Center of Porto (Catholic – Porto). The number of participants in this study was  $n = 122$ . Of these, 29 % were male and 71 % female. In Figures 5 and 6 the age distribution and the master courses attended by respondents are represented, respectively.

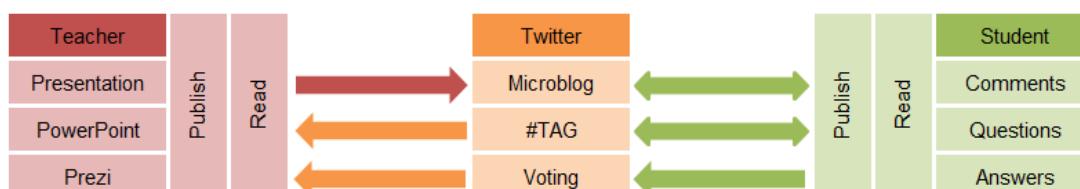


**Figure 5:** Age group



**Figure 6:** Training Undergone

The way the operationalization of the resource was made is represented, in schematic form, in Figure 7: the integration of Twitter in PowerPoint, with reference to a hashtag #, through which students could ask and answer questions, vote on matters presented and answer multiple choice questions. Thus, the electronic presentation, not only had the traditional function of transmitting information from one to many, but it was also intended to foster interaction content-students, teacher-students and students-students. The integration of Twitter in an electronic presentation, enables, potentially, a paradigm shift in teaching: to the one-way communication teacher-class is added the value of the interaction teacher-student-content. The feedback given by students is an important item because it allows the teacher to suit his speech to the class and answer students' questions and comments that appear in real-time presentation.



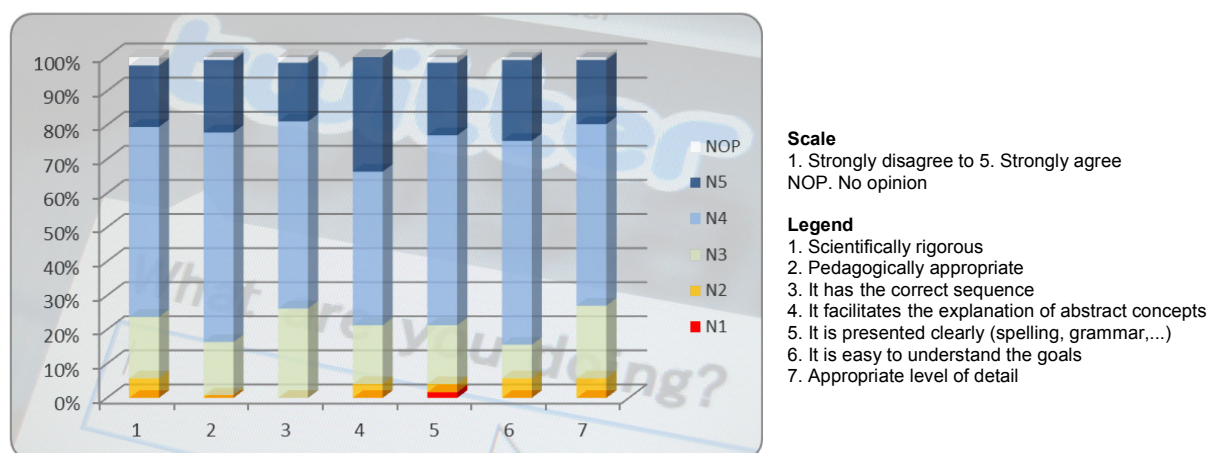
**Figure 7:** Integrating cognitive technologies in communication

At the end of the sessions, the participants were asked to fill a questionnaire to evaluate the resource. The convenience sampling technique was our choice. Although not representative of the population, this sampling technique had the advantage of being a fast and simple one and, therefore, suitable for preliminary studies, as in this case.

The questionnaire was made based on literature review (Hu, 2011; James et al., 2006; Kurilovas, 2007; Nesbit, 2007; Nokelainen, 2006) and consisted of 41 items spread across six dimensions: i) pedagogical aspects, ii) technological aspects, iii) cognitive learning, iv) interactions in the classroom, v) positive behaviour in the classroom and vi) negative behaviour in the classroom. The six evaluated dimensions include: issues that students identify as central in the quality of digital learning resources associated to more direct teaching and the perceived effects by students in the field of learning, behaviour and attitudes. A Likert scale of five points was used.

#### 4. Presentation of results

The overall results of the questionnaire indicate that the respondents recognize the pedagogical and technological potential of the resource in the six assessed dimensions, as well as its positive effects on the quality of learning and type of interaction. In Figure 8 the assessment on pedagogical aspects is presented. In the seven analyzed items, the large majority of respondents evaluated the pedagogical aspects of the course with level four, "agree" and level 5 "strongly agree." The global average of the seven items corresponds to 55 % of responses at level 4 and 22 % at level 5, and the importance of level 1 and 2 is negligible (0 % and 4 %, respectively).



**Figure 8:** Pedagogical aspects

As far as the "technological aspects" is concerned (Figure 9), the respondents commented on the appropriateness of the use of technology, design, usability, interface, added value compared to printed material, the potential of technology in facilitating learning, building concepts and skills

development. The average of the eight items of this dimension indicates that 52 % of students "agree" and 32 % "strongly agree" that the technology used was appropriate and that potentiated learning. Like in the previous dimension, the number of respondents that gave unfavourable levels of answers (levels 1 and 2) is negligible.

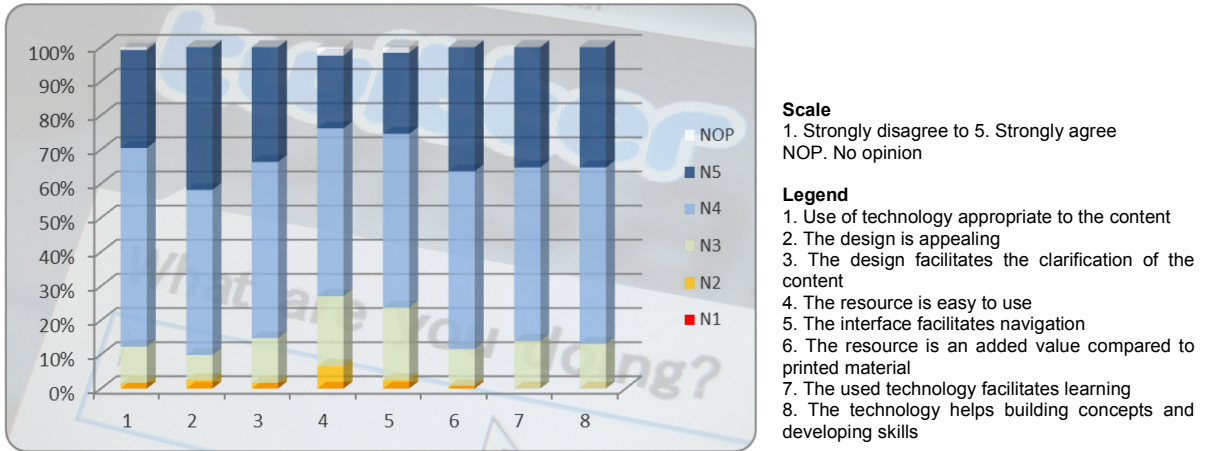


Figure 9: Technological aspects

Regarding "cognitive learning" (Figure 10), if one considers the average of the 11 items on this dimension: 82 % of the respondents said that they "agree" (47 %) or "strongly agree" (35 %) that the resource has positive effects. In the average of the 11 items, the value of the terms "strongly disagree" and disagree" is located at 2 %. However, 7% of the respondents "disagree" and 1 % "strongly disagree" that the resource facilitates taking notes (item 3).

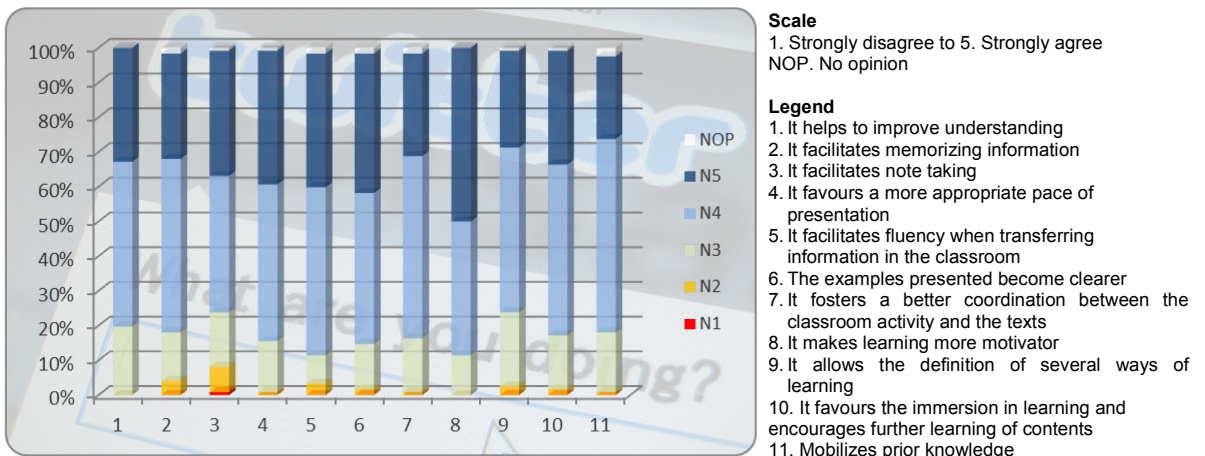


Figure 10: Cognitive learning

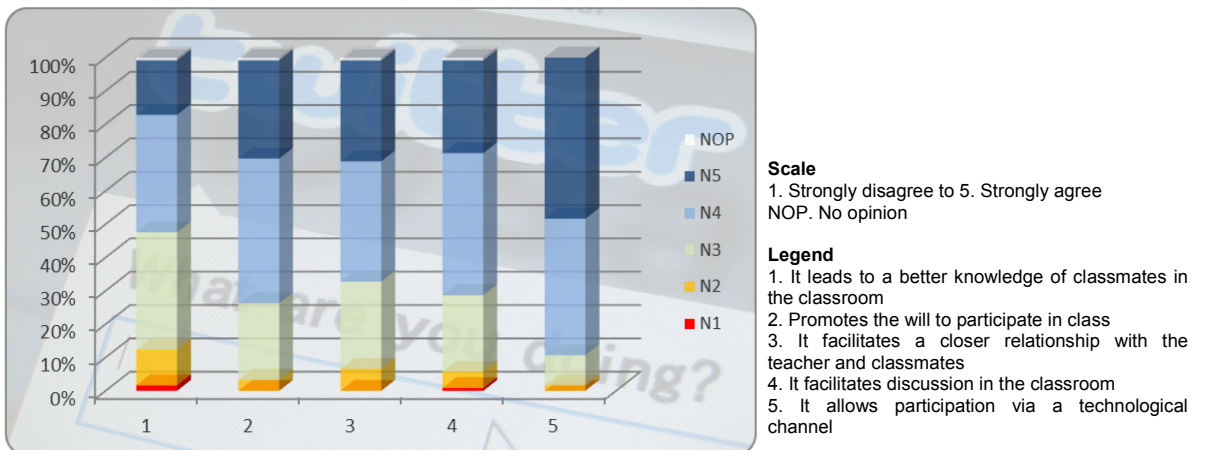


Figure 11: Interaction in the classroom

The potential of the evaluated resource in the "interactions in the classroom" are also recognized by the students. The average of the five presented items in Figure 11 indicates that 70 % of respondents "agree" (40 %) or "strongly agree" (30 %) with the positive effects of the resource on this dimension. The item 1 is the one that meets the highest percentage of negative and neutral answers: 2 % "strongly disagree" 11 % "disagree" and 35 % "do not agree nor disagree" that the resource leads to a better knowledge of the classmates in the classroom.

The results in the dimension "positive behaviour in the classroom" (Figure 12) are in agreement with those of the other dimensions. Considering the average of the 7 items, 75 % of respondents "agree" (49 %) or "strongly agree" (26 %) that the resource has positive effects on behaviour in the classroom. The item 1, which states that the resource helps taking better notes in class, holds the highest number of negative evaluations (1 % "disagree" and 15 % "strongly disagree"). This result is aligned with item 7 "it stimulates coming to class to take notes (15 % of respondents answered "disagree") as well as with item 3 in Figure 10.

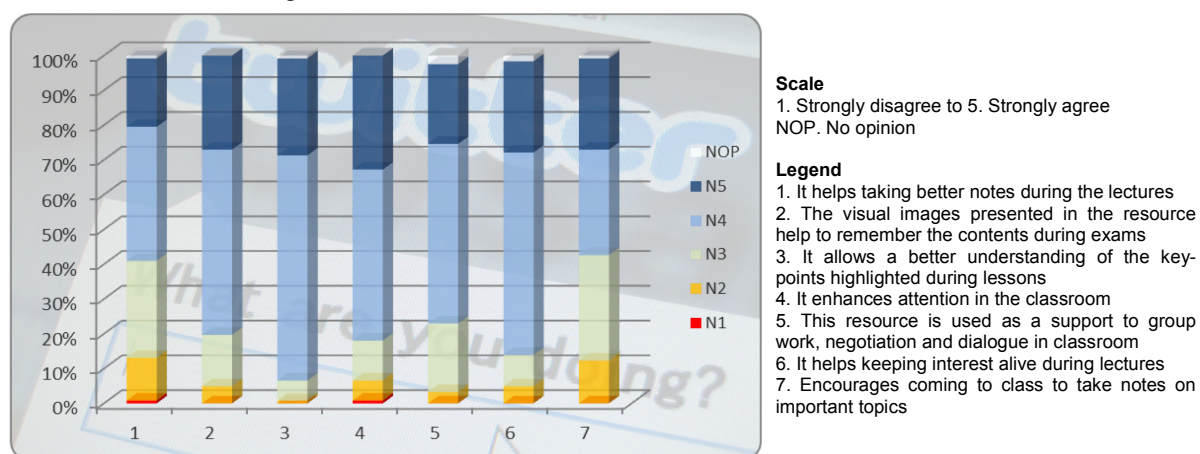


Figure 12: Positive behaviour in the classroom

In the dimension "negative behaviours in the classroom", the scale should be read in reverse: the more favourable views about the resource are located on level 1 and the less favourable in level 5. Looking at Figure 13 we can conclude that: i) 36 % "agree" and 19 % "strongly agree" that the resource increases the possibility of keeping side conversations while the teacher presents the subject, ii) 8 % "agree" and 8 % "strongly agree" that the resource reduces the motivation to be present in class. This figure (16 %), although low in percentage terms, assumes an important meaning and is not aligned with the very positive evaluation made to other dimensions and iii) 24 % "agree" and 7 % "strongly agree" that they are more likely to skip school if they know that the resource will be available on the web.

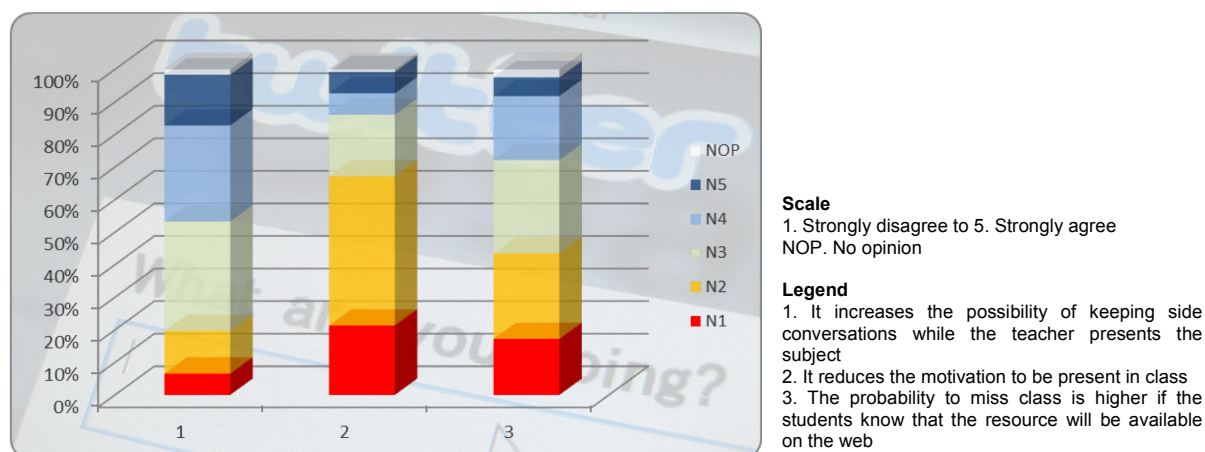


Figure 13: Negative behaviour in the classroom

Table 2 shows the average of responses in each dimension for each course attended. Only courses with 10 or more students were taken into consideration as it was assumed that courses with fewer students didn't have any statistical significance. However, it is important to state that the same class



could integrate students from various courses, which increases the dimension of students in each session. What was meant by this analysis was to identify possible differences in opinions according to the type of training. The students from *School Management and Organization* and *Childhood Education and Special Education* courses are the ones that, overall, make a more positive assessment of the resource used. On the same scale of 1 to 5, the average score for items 1 to 5 (item 6 was not considered in this average as it presents a reverse scale) was 4,3. The less favourable reviews were noted in the course *Pedagogical Supervision*, with an average of 3,7. Although the type and size of the sample do not make it possible to establish correlations between variables, the results of this preliminary study indicate that there is material for further analysis in this field.

**Table 2:** Average of results in each dimension per course

Training Undergone	Pedagogy	Technology	Cognitive Learning	Interaction in class.	Positive behaviour in class,	Negative behaviour in class,	Average items 1 to 5
Education and Music	3,8	4,1	3,9	3,8	3,8	3,2	3,9
Pedagogical Supervision	3,8	3,9	3,9	3,4	3,6	2,8	3,7
Infection and Health Care	4,1	4,0	4,4	4,2	4,0	2,1	4,1
School Management and Organization	4,0	4,4	4,5	4,3	4,3	2,5	4,3
Childhood Education and Special Education	4,2	4,4	4,3	4,0	4,2	2,4	4,3

An analysis of differences in various dimensions, by gender, was made in this study. In dimensions 1 to 5 no significant differences are visible. Gender disparities are only visible in dimension 6, which refers to negative behaviour in the classroom (Table 3). As shown in the three items considered, male respondents considered that the resource has more negative effects.

**Table 3:** Significant differences per gender

	Men	Women
1. It increases the probability to keep side conversations while the teacher presents the subject	3,7	3,2
2. It reduces motivation to be present in class	2,7	2,2
3. The probability to miss classes is higher if it is known that the resource will be available on the web	3,1	2,5

## 5. Results discussion

### 5.1. Implications

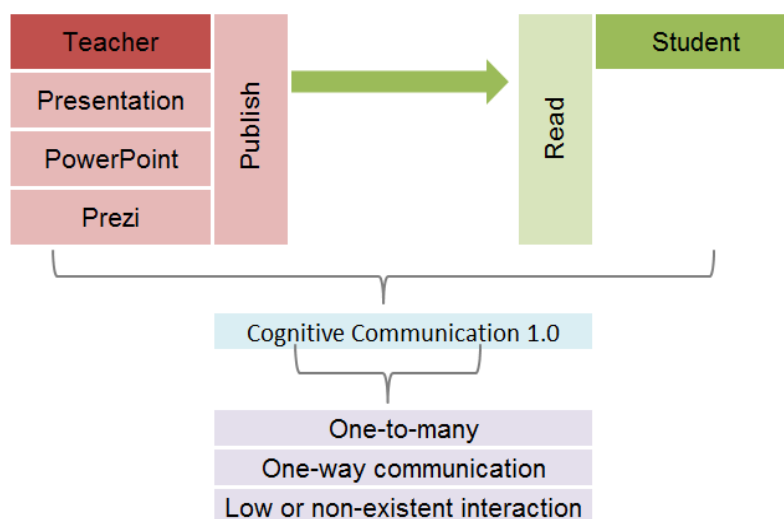
Constructivism as a philosophy and pedagogy is now widely accepted and is close to most contemporary theories of teaching and learning: "constructivism", "situated learning", "social cognition", "activity theory", "distributed cognition", "ecological psychology", and "case-based reasoning" (Jonassen, Howland, Moore, & Marra, 2003). Education policies, including the Bologna process, give expression to these pedagogical models of constructivist nature. In line with this perspective is the way new generations of students learn: in a more flexible way, not just playing the role of passive consumers of information, but as active builders in their learning process. The social media provided by web 2.0 support this new philosophy of learning based on community building, participation and sharing.

In fact, it has been observed that the social media – a collection of Internet web sites, services and practices that support collaboration, community building, participation and sharing – has attracted the interest of academics more likely to use technology in education and who seek new ways to motivate their students to a more active way of learning (Junco et al., 2010). In this exploratory study, promising indicators that suggest that web 2.0 tools can be integrated efficiently in the cognitive communication process of lectures emerged, with positive impacts in terms of teaching and

technology effectiveness, the encouragement of learning, the fostering of interaction and positive behaviors in the classroom.

There are several studies about the use of the web 2.0 tools potential as an approach to more constructivist philosophies. However, few are the studies focused on classroom lectures, where the teacher faces a class-group, consisting of several dozen of students with the need for direct instruction, to be able to present a large volume of information in the minimum time. In this context, which occurs often in higher education, dialogue and interaction are limited.

Figure 14 depicts the morphology of the communication process in a lecture to large groups, in which the electronic presentation only allows one-way communication, the interaction is not favored and the student is sent to a more passive role.



**Figure 14:** Cognitive communication morphology 1.0 in the context of a lecture

Mayer (Pennsylvania State University, 2010) admits the possibility of using resources more associated with direct instruction to achieve more constructivist approaches. In this study we sought to determine whether the integration of the web 2.0 tool Twitter micro blogging in a PowerPoint presentation contributed to the upgrade of a cognitive communication 1.0 to a cognitive communication 2.0 in the context of a lecture (Hu, 2011). The applied questionnaire allowed to assess various dimensions of the resource used in the classroom and to verify the changes in the morphology of cognitive communication. The results indicate that students recognize the potential of the resource used in the dynamics and dimensions of a cognitive communication situation 2.0, in particular with regard to: i) pedagogical aspects, ii) technological aspects, iii) cognitive learning; iv) interactions in the classroom and v) positive behaviour in the classroom.

In Figure 15 the results of the resource at interaction level and the direct effects on the student's activity are summarized. Twitter integration favours a multidirectional communication and an increase of the interaction between teacher-student, student-student and student-content.

This leads to an upgrade of the level of cognitive communication from version 1.0 to 2.0. The findings corroborate the results obtained when applying this questionnaire to a smaller sample (Ferreira, Castro, & Andrade, 2011) and are aligned with other studies, namely: i) the positive effects on learning (Balanskat, Blamire, & Kefala, 2006; James et al., 2006; Junco et al., 2010) and ii) the relation between the use of technology and the student involvement in school activities (Balanskat et al., 2006; Chen P., 2010; Junco et al., 2010).

There are still significant sectors of conservatism and resistance to change in HEIs through technology: "Institutional barriers present formidable challenges to moving forward in a constructive way with emerging technologies. Too often it is education's own processes and practices that limit broader uptake of new technologies. Much resistance to change is simply comfort with the *status quo*" (Johnson et al., 2012, p. 6). Only with more research can the potential of technology be demonstrated, namely in the exploration of the social media and in the upgrade of the cognitive

process of communication from version 1.0 to 2.0, in order to align it with the way the Net Generation thinks and learns.

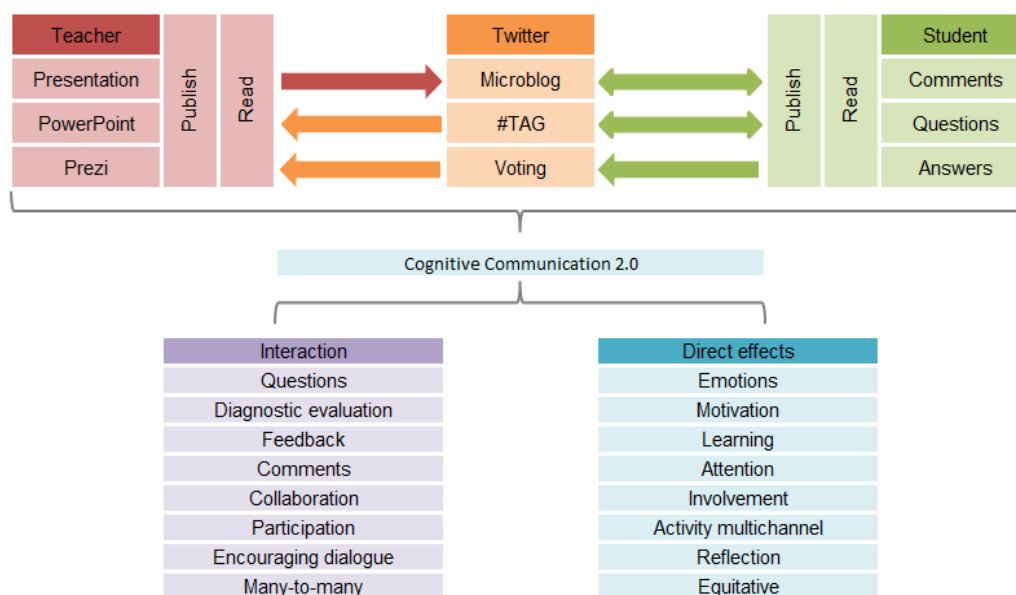


Figure 15: Morphology of cognitive communication 2.0 in the context of a lecture

## 5.2. Limitations

The main limitation of this study relates to the fact that it was done with a specific sample, consisting of a small number of masters students at Catholic – Porto, which is not necessarily representative of all HEIs. In addition, only master's students belong to the sample, which requires some conservatism in the transposition of the reading of the results for other levels of education, particularly for undergraduate students. Aspects such as maturity and experience of students in the use of the social media were not manipulated and can be crucial in explaining the results.

## 6. Conclusions

The pedagogical change and innovation in higher education through technology, namely through the exploration of social media in teaching activities, is a hot topic in research. However, the literature reveals lack of studies on this subject in the context of lectures. Despite the loss of centrality of lectures on research, they remain a fundamental element in the organization of teaching activity.

Mandatory time-saving and teaching organization lead teachers to rely upon mechanisms of direct instruction in lectures, which contributes to the immutability and conservatism in cognitive communication. As a result we have a model of communication 1.0, where the communication is predominantly from one-to-many, in which the student plays a passive role in receiving the information. This communication model is opposed to the communication model 2.0, closer to the constructivist philosophy, which reflects the way students learn in the Information Society, where they assume an active role, interactive and collaborative in the construction of their knowledge.

As an approach to the theme of cognitive communication 2.0 in the context of lectures, with the integration of the social media, we have developed an exploratory study, which consisted of the use of a PowerPoint presentation with the integration of the micro blogging tool Twitter. This feature allowed students to comment, question and debate the subject in real time. The comments, visible in PowerPoint, allowed the teacher to re-orientate his speech, without interrupting it, and enabled the students to read their peers' views and to contribute with their own perspective to the debate. It also allowed the release of multiple choice questions to the audience, with answers via Twitter and the projection of results via PowerPoint. This way, a true cognitive communication 2.0 took place.

The results obtained through a questionnaire distributed at the end of the session, indicate that students recognize the potential of this tool in the dimensions evaluated: i) pedagogical aspects, ii) technological aspects; iii) cognitive learning, iv) interactions in the classroom and v) positive

behaviours in the classroom. The conclusions reached are in line with the results of the literature on the integration of social media, in other contexts of training activity:

- The digital resources have positive effects on learning (Balanskat et al., 2006; James et al., 2006; Junco et al., 2010)
- The use of educational technology and student involvement are related (Balanskat et al., 2006; Chen P., 2010; Junco et al., 2010)
- The digital resources, which integrate communication tools, increase student participation in the activities. The use of Twitter helps remove psychological barriers, increasing the participation of more introverted students (Junco et al., 2010; Kruger, Epley, Parker, Ng, & W., 2005; OECD, 2007).

## 7. Future work

For future work, it is suggested i) to extend the sample in order to validate the questionnaire and to allow the study of correlations between variables and ii) to repeat this study with students from other academic levels and doctoral degrees and from other institutions.

The polling systems are systems of "voting" which allow to for the creation of interactions on multiple platforms: between smartphones, via sms, e-mail or web pages. This potential to probe the audience can help to gauge the effectiveness of communication and students' involvement. It is, therefore, considered a fertile field for future investigations.

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