ORIENTATING PEDAGOGY TOWARDS HYBRID SPACES

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Abstract

The huge spread of network and mobile technology offers new dimensions and spaces for interpersonal interaction. The present-day "always-on" condition erases any clear distinction between physical and digital spaces, introducing a new, so-called "hybrid", conception of space.

Hybrid spaces are dynamic and characterised by constant connectedness, whereby remote contexts are integrated with the space/time dimensions of the here and now.

The aim of this contribution is to illustrate how these spaces have gained increasing importance in pedagogy, and to examine the risks of an over-simplistic, reductive interpretation of the Bring Your Own Device (BYOD) approach.

Thus there will be a discussion of the pedagogical, teaching and instructional design aspects of an educational process which is destined to develop more and more in *hybrid learning spaces*, and where the real and virtual blend together, losing their separate connotations.

Examples from university experiences will be presented to illustrate the close interdependence of these aspects.

INTRODUCTION

If we examine the recent history of educational technology, we can identify at least three stages in the long, slow process of introducing information and communication technologies (ICTs) into school teaching (Trentin, 2013).

Stage 1 (mid-'eighties – late 'nineties) – *The ICT are installed and used inside a classroom* (the computer room) which has been set up for this specific purpose, where computer-aided study takes place, or use of the computer and programming languages are learnt.

Stage 2 (late 'nineties – early 2000s) – *With ICTs, particularly communication technologies, the classroom walls (of the computer room) are knocked down.* The computer is

no longer seen as a tool to be programmed or for running educational software, but also as a powerful means for both accessing information and digital repertoires, and making contact with other realities: other students, experts, research institutions, etc. For most students and teachers, the online connection made available by the educational institution remains however the only means to access Internet.

Stage 3 (early 2000s up to today) – *The classroom is extended into virtual space, fostering so-called "hybrid learning"* (Kaleta et al., 2007; Kali et al., 2007). With the diffusion of Internet, both at home and in mobile forms (WiFi technology, netbooks, tablets, smartphones, etc.), the idea of "computer room" becomes obsolete, since the learning activities supported by the network can be developed anywhere: in a normal university classroom, in a library, at home, on a park bench.

In addition, in contrast to the Stage 1 and 2 situations, today the most up-to-date and used technologies are not the ones made available by university structures (with the obvious exception of the specific scientific/technological departments), but rather those which the students and already many teachers use daily, which they have at home or carry with them in their pockets, bags or backpacks. So much so that a specific term, *Bring Your Own Device* (BYOD), has been coined for this practice (Alberta Education, 2012).

The term BYOD indicates that nowadays students and teachers more and more frequently use their personal devices for teaching and learning, during the lessons or for studying alone or in group. The terms *Bring Your Own Technology* (BYOT), which means the same thing as BYOD, and *Bring Your Own Browser* (BYOB), which emphasizes the use of one's own device to access cloud technology services, are often alternatively used. Later, priority has been given to the term BYOD, since it in fact incorporates the other two (Bray, 2013).

The concept of BYOD thus originates in the mass spread of mobile devices which, besides being part of our daily lives, amplify (a) the dynamicity of interactions among people and with online resources, and (b) the spaces in which these take place.

This situation moreover contributes to making the line separating physical spaces (eg. the classroom) from digital spaces (eg. online learning environments) increasingly less clear-cut, leading to a new view of the space of interaction which we might define as "hybrid" (Figure 1).

Hybrid spaces are dynamic spaces created by the constant movement of users who carry portable devices which are continuously connected to the Internet and other users.

This "always-on" status transforms our perception of space to include contexts which are remote from those we are actually living in at that moment. In this sense, a hybrid space is conceptually different from what we call *mixed reality*, *enhanced reality* or *virtual reality* (De Souza e Silva, 2006).

In this radical change of scenario, learning spaces too can thus take on hybrid connotations (Figure 2).

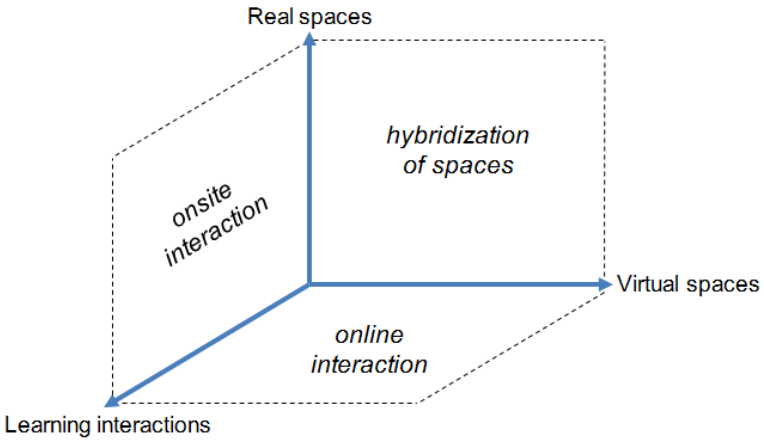


Figure 1. Interaction spaces and hybridization of spaces.

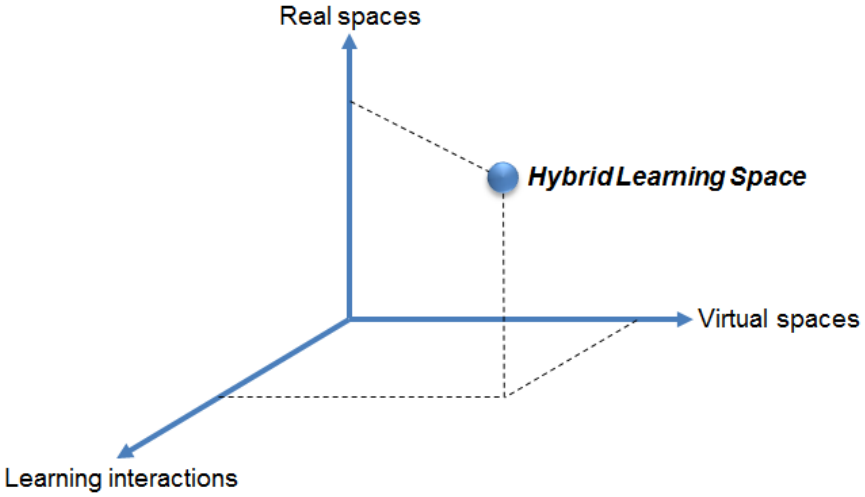


Figure 2. Hybrid Learning Space dimensions.

The potential of hybrid learning spaces is considerable. However to be able to exploit them to the full, it is necessary that an adequate pedagogical scheme be applied to the HLS concept. This scheme should foster real didactic innovation which will improve, enrich and potentiate teaching/learning processes.

This is a crucial step if we wish to ensure that the innovation is not only technological (because there is a personal use of network and mobile technologies - NMTs[1]) but also and above all didactic/methodological.

Alas, many alarm bells can already be heard. For example, the gap between the personal/daily/informal use that students and many teachers make of the new NMTs and the way in which, instead, these same means are used/proposed in so-called "institutional teaching", is constantly widening (Trentin, 2013). What can clearly be perceived is a kind of

[1] In this article, the term NMT is used in a fairly wide sense, incorporating both communication technologies and web resources which can be used through them (e.g. cloud, social media, instant messaging, apps for collaborative work etc.

"backstage use" of technology, a sort of parallel use to the one in the institutional-space context, and a much faster one:

- on the one hand the students, assiduous users of social networks also for interacting with classmates or for accessing documental resources to further their studies;
- on the other hand the teachers, who are also increasingly often technology and online resource consumers, but who however limit themselves to using them in the preparation stage of the classroom activity, rather than in fostering learning processes which make study inside and outside the institutional spaces increasingly indistinguishable and interchangeable.

A strong contribution to this distinction very likely comes from (a) the way the institution conceives of the spaces and times for creating new teaching/learning processes which really integrate the use of technologies and (b) teachers' poor knowledge of how to plan teaching activities which can fully exploit the NMT potential.

It is in fact clear that most of the NMTs used today in teaching activities (or to support teaching) are of a general-purpose type, or not created for a specific context, particularly not the educational one. Thus they cannot be considered as true educational technologies. Consequently, it is the way their educational use with students is planned that can give them this specific connotation. And to do this efficiently, Roth and Erstad (2013) suggest thoroughly studying how students and teachers use NMTs in their daily lives. From this we can understand the right process for adapting them to the new typically 21st-century learning needs and methods, rather than persevering in the normal teaching practices which are unstimulating and boring for the new generations.

Hoping to offer a useful contribution to the ongoing debate, this chapter will discuss the pedagogical, teaching and instructional design aspects of an educational process which is destined to develop more and more in hybrid learning spaces (HLS), and where the real and the virtual are blended together, losing their separate connotations.

HSL: PEDAGOGICAL ASPECTS

The key aspect of HLS to be considered is not so much the quantity and quality of the technologies and network resources used, as *why* and *how* to use them effectively, i.e. how to potentiate, improve and, why not, revolutionize teaching/learning processes to adapt them to the new ways of communicating and acquiring knowledge which NMTs have produced in everyday life. All this must be based on the increased reciprocity of technological functions and pedagogical approaches. As Cousin (2005) in fact declares, pedagogy cannot ignore the communicative methods which are typical of the new media, and likewise technological development should ideally respond to the indications of pedagogy, thus fostering a process of mutual, beneficial "contamination".

As a matter of fact, thanks to the type of technology we have at our disposal, it would already be possible, as McLoughlin and Lee (2011) inform us "…*to open the doors to a more participational, personalised and productive pedagogy".*

We must however be aware that successful integration of NMTs into teaching must depend on: (a) clear definition of the educational needs for which they are to be introduced; (b) corresponding planning of the teaching activities aimed at fulfilling these needs; all this must be amalgamated by (c) targeted, skilful training of teachers for the development of those specific activities (Trentin, 2013).

The impression is that too often things have proceeded in the reverse direction: projects have been launched for introducing technologies into teaching, certainly with the admirable intention of stimulating curiosity and ideas about their use in this specific context. Almost always however they have resulted in a patchy return of investment, which most of the time offers no clear indications for wide, sustainable diffusion of those technologies in teaching and learning.

It is thus evident that the starting-point should be identification of the specific pedagogical approaches which might effectively be enhanced by the new technologies (Beetham and Sharpe, 2013), with a view to fully-fledged renewal of educational practices in order to bring them in line with the needs and habits of a user population composed of information "prosumers" (i.e. producer/consumers). Then the conditions which would favour large-scale diffusion of this process of renewal should be worked out and created.

Let us take an example. Let us consider the *learning-by-doing pedagogy* worked out by Dewey (1916) according to which:

> "… students should be given something to achieve, not just something to study; doing requires 'thought and reflection' and an attention to 'interconnections'; for this reason learning is naturally generated by doing".

Dewey worked out this concept at the beginning of the last century. Today, however, the new technologies offer a solid framework for it to be fully applied, particularly as regards the development of "thought and reflection". Amongst other things NMTs, unlike paper and pencil technology, can more effectively support students in building up and/or searching for "interconnections" (think hypertextual artefacts).

Learning-by-doing pedagogy is based on the premise that the student must have control over and responsibility for his own learning process. To do this he/her must however be provided with suitable tools and resources. The teacher acts as a mentor, a guide who helps shape and direct the learning path, encouraging and nudging the learner. But when the teacher finishes his/her action of direct facilitation of the individual (or learning group), technology can take over and offer learners (or learning group) other types of support, enabling them to pursue their learning path autonomously. Clearly this possibility will be decisive (in some case the only alternative) in those particular situations of disadvantage which prevent regular participation in classroom lessons, either temporarily or permanently (Trentin et al., 2015).

A first conclusion which might be drawn from this example is that, while on the one hand NMTs would allow students to be more easily involved in learning processes centred on doing, teachers too should consequently receive more encouragement to propose this type of approach.

This might be true pedagogically speaking, but it is not enough for a real, lasting large-scale integration of NMTs into teaching practices. Parallel to the pedagogical choices, other key elements need to be defined to guarantee the sustainability of this integration into the institutional context. Two in particular: (a) new ways of planning/organising teaching which

favour technology-potentiated pedagogical choices; (b) professional development of (teaching and non-teaching) staff.

In short, from what has been said so far there are three main dimensions (at least from the point of view of teaching/learning processes) which might contribute to the sustainability of the introduction of technologies into the didactic context (Trentin, 2007; Trentin and Alvino, 2011): (a) the didactic/pedagogical dimension (connected to the teaching of the individual discipline); (b) the didactic/organizational dimension; and (c) the professional development dimension, in the first place for teachers.

This third aspect is particularly delicate, because an HLS-centred teacher means the reconfiguration of the teacher's role from teacher to hls-oriented teacher (*hls-teacher*).

From Teacher to HLS-Teacher

In a HLS, the figure of the teacher continues to be central, although his/her function changes as compared to exclusively face-to-face teaching. From teachers delivering a lesson they become facilitators in the process of learning content which they are expert in, contributing to the preparation of the teaching materials and/or supervising their students' interactive activities, both online and face-to-face. How far their function is modified obviously depends on the type of approach adopted, for example whether it is more centred on the teacher or on collaborative study.

A HLS requires both teachers and learners to take on different roles and responsibilities from those in a traditional class (McLoughline Lee, 2011). Elliot (2008) have in fact for some time now been calling for the development of an *e-pedagogy* based on the rethinking of traditional teaching practices.

Teachers who intend to adopt NMTs in their practice therefore need fully to understand the philosophy underlying the concept of HLS and the paradigm shift it involves. Traditional teaching/learning practices are focused on the teacher, whose objective is to transfer a given body of knowledge directly to learners. By contrast, hls-teaching concentrates on the relationship among learners, and that between learners and the knowledge to be acquired. Students are helped to be more autonomous, proactive and responsible towards their own learning processes.

Table 1 summarises and compares the main characteristics of traditional teaching (which may also make use of technology) and those related to the hls-teaching paradigm.

To recap, then, systematic uptake of hls-oriented pedagogy (*hls-pedagogy*) is conditional on teachers having access to suitable professional updating so that they become capable of making autonomous and informed decisions about which hls-teaching strategies will prove most effective for meeting the needs at hand.

Moreover, given the particular features of online environments, which are certainly different from the physical environments of face-to-face lessons, the teacher must be trained to choose the most adequate strategies of interaction /didactic communication to fit the medium they are to be used in.

This is a particularly critical competency for teachers; acquiring it should help dispel any impression they may have that the educational use of NMTs simply means transferring the contents and teaching approaches that have proved effective in the classroom onto Internet. In fact, the special characteristics of a given medium mean that it is never neutral in terms of communication dynamics and strategies. For example, video, audio and multimedia each have

their own characteristic pace and timing; also text communication, which is typical of electronic messaging systems (e-mail, forums, social networks etc.), where the expressivity (tone of voice, interlocutor's expression etc.) filtered by the medium often needs to be substituted with artifices such as the so-called *emoticons*.

Table 6.1. Comparison of traditional teaching and hls-teaching

	traditional teaching	**hls-teaching**
teacher	possesses and transmits knowledge	guides study
student	passively receive contents	interacts with contents and the tutor/teacher, learns autonomously and in groups
class	place where knowledge is induced	place where knowledge is built and shared
knowledge and experiences	transmitted vertically from teacher to learners	shared horizontally among members of the learning group, which includes the teacher
learning processes	strongly directed	active and collaborative
curricular contents	predefined and standardised	flexible and open-structured so as to permit multiple learning paths
NMTs	mainly used to support classroom lessons	the means for realise HLS
teacher's perceptions of Educational Technology (ET)	teacher considers ET as a surrogate for their own role	ET is considered a means for stimulating learners, for improving and amplifying the learning environment (HLS)

Willingness to Engage in HLS-Teaching

Once the teacher is sufficiently convinced about the validity of the HLS idea, the next issue is his/her willingness and chance to modify teaching methods. In other words, what boundary conditions are to be considered for supporting hls-teaching? Some of these are:

- feel comfortable with one-to-one interaction and debate;
- be flexible in teaching and interested in innovation;
- be willing to use multiple online services in teaching/learning processes.

While these may not appear to be particularly stringent conditions, many excellent classroom teachers are unable to meet them. The reasons for this include difficulty in getting used to regular online interaction with learners, in adjusting to the demands of CMC (Computer-Mediated Communication), and in feeling comfortable with technology.

From the above, we can derive some preconditions for becoming an effective hls-teacher, in particular the need to:

- feel comfortable with tools and systems for teaching and learning online, such as cloud technology, social media, virtual learning platforms, etc;
- have prior first-hand experience of learning online. This is essential for understanding the potential advantages and pitfalls of NMT-based learning from the learner's viewpoint.

Online training is the best means of ensuring that the prospective hls-teacher satisfies the last two preconditions. In this way, trainees will have gained learning experience using the same tools and methods that they will later adopt themselves in their own e-teaching activities (Trentin, 2010).

HLS: TEACHING ASPECTS

In university teaching there are various ways of seeing *hybrid teaching solutions* (e.g. Graham et al., 2013). The reason for this lies in the concept of "hybrid", i.e. the blending of different teaching approaches in varying combinations when proposing learning activities for one or more educational goals. Although the aspect of hybrid teaching solutions which is normally most emphasized is the alternation between face-to-face and distance learning activities, the concept of "hybrid solution" actually refers to the integration of different methods and teaching tools rather than to the space/time dimension. In fact, the concept of "hybrid" is used to cover a mixture of various teaching approaches, either exclusively face-to-face or distance teaching or a compenetration of the two (Bocconi and Trentin, 2014).

In this section, instead of emphasizing the alternation of face-to-face and distance learning, and in order to underline the role of NMTs in enhancing the particular characteristics of HLSs, the terms "onsite/online" are used to refer to the learning process which takes place respectively *onsite*, in a physical space (a classroom lecture room, collaborative laboratory, in the library or at home), and *online*, i.e. in virtual spaces (according to the canons of online education). Furthermore, it is useful to observe also that an online activity is not always limited to the time between one onsite activity and the next, but may extend over a much wider timespan, being conducted in parallel to several face-to-face activities.

Figure 3 shows the hybrid solution developed across three main dimensions, namely the *learning process* (collaborative, individual), the *settings* (classroom, extra-classroom) and the *learning space* (onsite, online), creating a fluid continuum that is the learning path (Trentin and Bocconi, 2014).

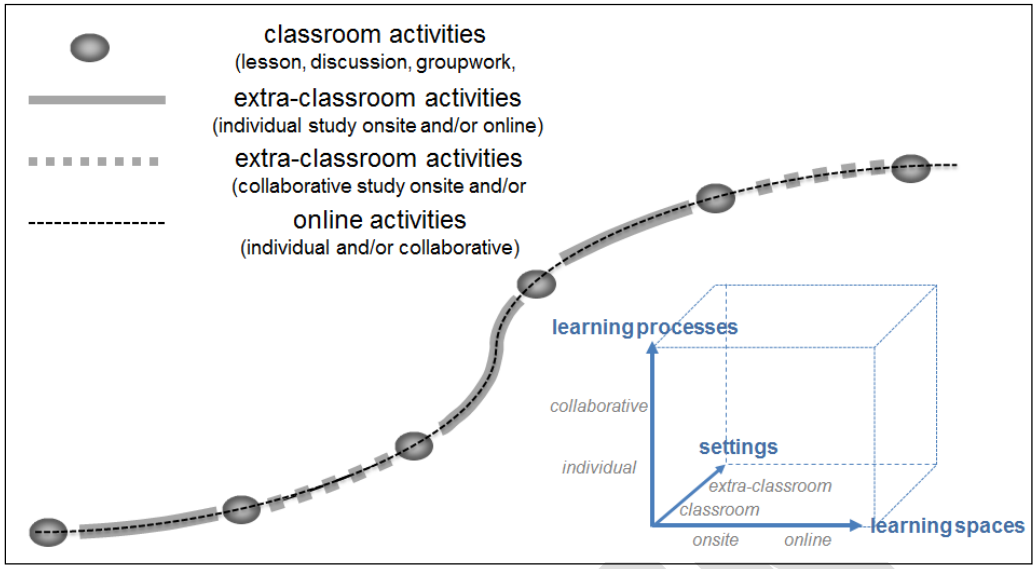


Figure 3. Mixing online and onsite activities in classroom and extra-classroom settings.

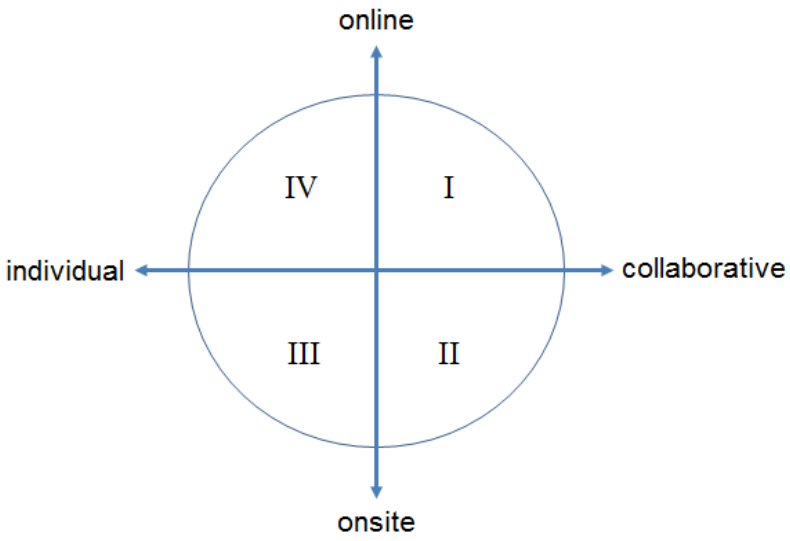


Figure 4. The bi-dimensional space (onsite/online learning – individual/collaborative learning) characterizing a hybrid learning solution.

Hence, the balance between *online* and *onsite* learning activities in a HLS can vary considerably, strongly depending on the pedagogical setting. In fact, the creation of a hybrid solution must be based not only on an adequate integration of teaching methods and tools, but also on pedagogical considerations such as the correct dosage of onsite and online components. In other words, onsite activities must help lay the foundations for a more effective development of subsequent online activities, defining goals, assignments, deadlines and expected results. In the same way, online activities must be organized so as to be functional (or even indispensable) to the next onsite meeting (Trentin and Wheeler, 2009).

In order to understand how the specific characteristics of the hybrid solution can be exploited in higher education settings, a bi-dimensional space can be defined as illustrated in Figure 4.

These two dimensions are combined to form four quadrants, each with specific types of situation to enrich both the teaching-learning and the assessment processes within a HLS (Bocconi and Trentin, 2014): (I) online-collaborative learning; (II) onsite- collaborative learning; (III) onsite-individual learning; (IV) online-individual learning.

The first quadrant (*online-collaborative learning*) concerns the learning process that takes place at community level in virtual social spaces (e.g. social media, CVE- collaborative virtual environments, CSCL systems, etc.). The focus is on the use of NMTs to facilitate online interactions and collaboration among individuals. From a learning point of view, NMTs not only support and improve students' online collaboration, but also enhance their self-help dynamics. They amplify groups'/individuals' reciprocal interactions concerning the application of what they have learnt and concerning socializing problems. As part of summative assessment, network technologies can help university teachers to monitor and assess three key aspects of collaborative learning: (a) students' collaboration process; (b) group final product; and (c) individual students' learning outcomes (e.g. Swan et al., Hiltz, 2006). Objective data automatically traced by NMTs (e.g. number of messages, analyses of the structure and intensity of the social interactions developed online) can be combined with subjective data (teachers' evaluation, peer evaluation conducted inside the learning community), thus allowing conclusions to be drawn about both the individual students' and the group's contributions to the collaborative process (Bocconi, 2012; Trentin, 2010).

The second quadrant (*onsite-collaborative learning*) refers to the learning process that takes place at group level in physical spaces (e.g. library, home). Both students and teachers use NMTs to support and amplify group knowledge exchange, thus moving communication and collaboration outcomes out of the physical/local context in which collaborative learning actually takes place. From a teaching perspective, NMTs can facilitate the organization and management of in-class interactions, by allowing teachers to automatically collect and organize data and give students immediate feedback on group discussions. For instance, network technology allows a real-time Delphi-like technique (Hsu and Sandford, 2007), facilitating teachers' real-time calculations and visualizations of students' replies. In the process of completing this group task, students are invited to reflect upon a proposed concept/problem and send their definitions/solutions to the teacher. Teachers automatically process groups' data and in real time return an overview table including all replies, inviting students to review other groups' definitions and to modify the initial one if they feel it is needed.

The third quadrant (*onsite-individual learning*) indicates the learning process that takes place at individual level in physical spaces (e.g. classroom, library, home). NMTs are means to amplify the information and communication process between teachers and students. For example, mobile technology can be used by the teacher to collect students' on-the-spot insights on topics presented during traditional lectures (e.g. using a Twitter 'hashtag') (Luckin et al., 2012), thus providing all students with equal opportunities to engage with contents and to self-assess their understanding of the concepts before leaving the classroom. From a teaching perspective, the use of NMTs also allows teachers to increase the level of individual participation during traditional classes. Range and time can also be optimized and a wider set

of data can be gathered, overcoming the limitations of traditional onsite-individual learning settings (e.g. helping to detect individual learning needs in large face-to-face classrooms).

Finally, the fourth quadrant (*online-individual learning*) deals with the learning process that takes place at individual level inside virtual spaces (e.g. immersive learning environments, remote labs, interactive simulations, etc.). NMTs thus provide the "learning space" where learning processes occur, also giving continuity to students' learning interactions activated in onsite contexts. From the learning point of view, network technology enables students to engage in real-time, hands-on experiments such as using instruments via remote online laboratories. Conducting experiments motivates students and allows them to formulate hypotheses (i.e. inquiry-based learning), thus making learning more effective (Luckin et al., 2012). Regarding assessment, NMTs offer university teachers the opportunity to track students' complex activities by collecting a wide range of data about their decisions and action modes in remote learning environments.

To sum up, in onsite-individual and onsite-collaborative dimensions, NMTs mainly serve as a generic "information and communication space" that amplifies knowledge sharing, while the learning process still takes place inside the physical space, at individual and/or at group level. Accordingly, in online-individual and online-collaborative dimensions, NMTs provide the "learning space" where the learning process actually takes place.

HLS: INSTRUCTIONAL DESIGN ASPECTS

Once the pedagogical and didactic aspects have been discussed, the next step is to define the criteria for planning, organizing/ "designing" didactic communication within a HLS in order to generate an effective teaching/ learning process.

Moreover, these questions need to be dealt with in conjunction with those regarding the assessment dimension, i.e. how to use the same didactic planning and communication to analyse (a) whether and how things are proceeding towards the declared learning goals and (b) individual contributions to the collaborative process developing within the learning group.

All these considerations demonstrate the need for effective instructional design of the activities to be developed within the HLS, gearing them both to the achievement of the declared educational goals and to the assessment of the level of that achievement and of the process (Trentin and Bocconi, 2014).

It should immediately be pointed out that the teaching/learning and the assessment processes must necessarily interact with each other. In other words, when planning the teaching activity the path to be followed by the students should be made both *observable* and *traceable*, so that useful information for the assessment process can be gathered from their individual and/or group actions.

The assessment process may concern: (a) the individual student (e.g. levels of learning, of active contribution to group work etc.); (b) the products developed during the proposed activities (artefacts, problem-solving, exercises etc.); (c) the teaching process used by the teacher to achieve the declared goals.

By "observable" is meant any activity which can actually be observed by the teacher, such as a forum discussion, allowing conclusions to be drawn not so much (or not only) about each individual student's level of active participation, but also about their way of using the subject-specific terminology and of arguing their opinions and/or choices, etc. These are very

important elements for helping the teacher understand what progress the students are making in the acquisition of subject-specific knowledge or transversal knowledge (group work, correct manner of expressing oneself, arguing one's opinion etc.).

By "traceable" is meant any activity that leaves "digital traces" which can be analysed asynchronously by the teacher, such as e.g. the outcomes of an online test or the above-mentioned forum. Besides being observable, this is also traceable, in the sense that it leaves a written trace of the various interventions, which can be read afterwards by the teacher and assessed according to the level of active contribution to the discussion.

Other digital traces which are useful for assessment purposes are those recorded by the social media, for example the chronology of the modifications of a group-generated document (e.g. a wiki). This allows analysis of the series of modifications made by each student and their level of contribution to the co-construction of an artefact (Judd et al., 2010; Trentin, 2010).

At this point, it is clear that the instructional design phase cannot be separated from the one regarding the monitoring system (and more generally the assessment process), if we wish to fully exploit the observability and traceability of the students' actions for the assessment of either the learning process or the HLS itself.

So in planning a hybrid solution, it is good practice to choose the best combination of its components, bearing in mind both the goal to be achieved and the method to be used for assessing its achievement.

In this sense, the design approach should indeed be reversed, i.e. first establish the monitoring system for the assessment, then construct the teaching activity in such a way as to favour the collection of the data and information for this system.

This is the approach in fact followed in the *Polaris* instructional design methodology, developed within the project of that name for the online training of schoolteachers, and subsequently refined in web-enhanced learning projects in several Italian universities (Repetto and Trentin, 2011).

The key point of this methodology is a clear, unequivocal definition of the learning objectives. Next, the ways of assessing their achievement are worked out, and only then are the teaching activities structured, so as to create the above-mentioned observable and traceable path.

Learning objectives consist of a detailed, structured list of expected learning outcomes. Therefore, each objective must be accompanied by an explicit statement of what the student must know or be able to do with respect to the corresponding learning topic. Proper definition of objectives has a strong impact on subsequent steps in design, and especially on the mechanism used to evaluate both the course as a whole and learning in particular. The way objectives are formulated should generate hints about the mode to be used for gauging their achievement. It is useful to distinguish between general objectives applicable to, say, a course module, and the specific objectives of a *learning unit* or part thereof. Objectives can be structured in a variety of ways, including arrangement in a taxonomy (Bloom, 1956) or in a hierarchy of main and subordinate objectives (Gagné, 1970).

One last observation on this phase is needed. Following the preliminary definition of objectives, it is advisable - before moving on to the subsequent steps in the design process - to stop and ask oneself how achievement of each single objective is to be evaluated.

It is an extremely efficient test, which provides important feedback about the coherence of the structuring/definition of the objectives and about what assessment tasks to set for the

objective and/or subjective measurement of their achievement. This is in line with the commonly-held belief that the key elements for defining assessment measures should emerge from the act of formulating the objectives themselves (Rowntree, 1981).

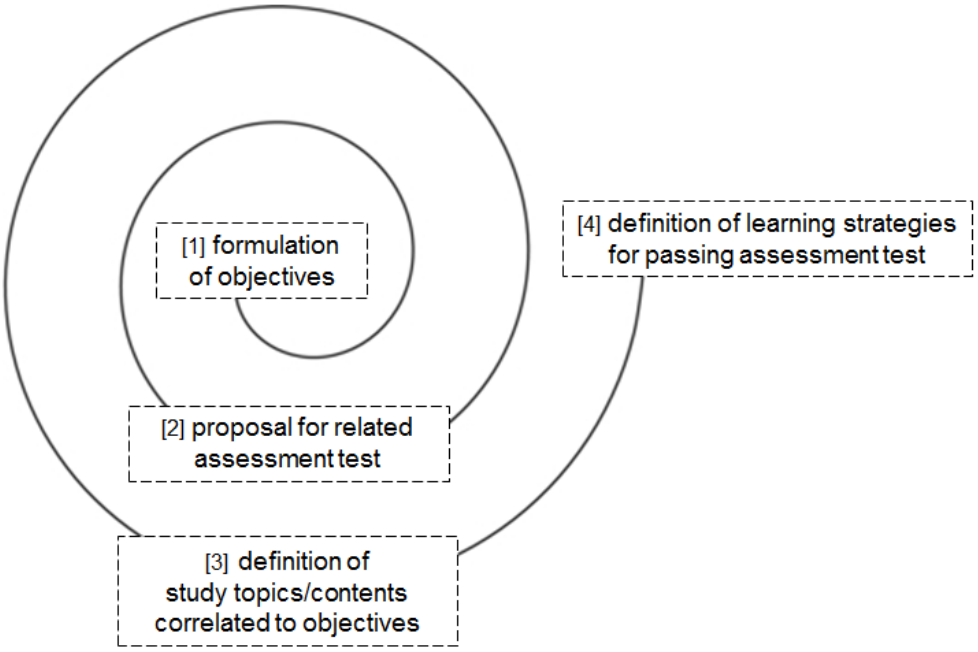


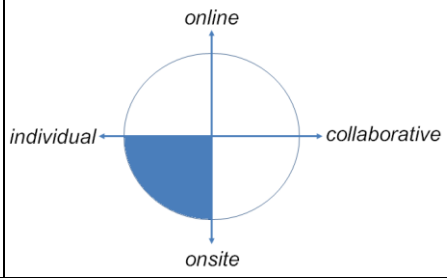
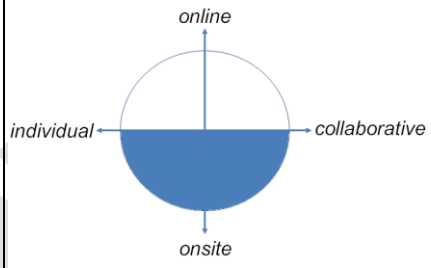
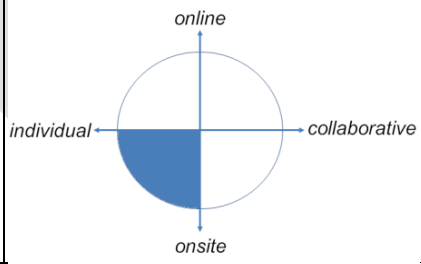
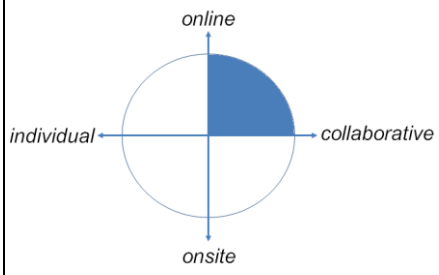
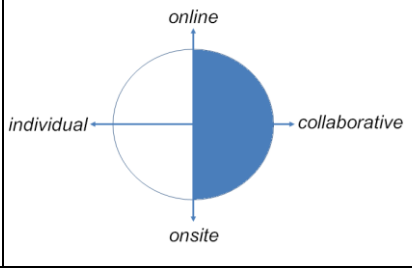
Figure 5. Formulation of objectives as a reference point in instructional design.

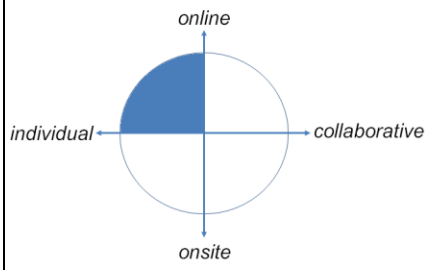
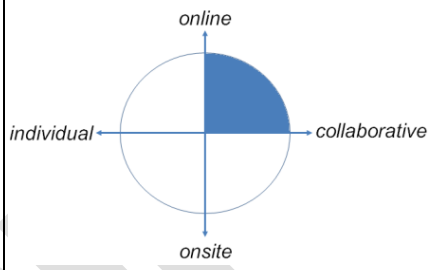
These points are a clear indication of just how important the formulation and structuring of objectives is within instructional design, and also of the impact that this crucial aspect can have on other elements. Indeed, definition of objectives can be seen as the starting-point in a circular design process that links assessment, content definition and identification of learning methodologies for reaching expected learning outcomes (Figure 5).

As shown in Figure 5, the logical sequence should be as follows (Trentin, 2010):

1. formulate an objective using clear, unambiguous action terms (e.g. “know how to solve first-degree equations”);
2. identify an effective means for evaluating achievement of that objective (e.g. “set first-degree equations”);
3. define contents suitable for studying the topics related to the learning objective;
4. define a learning strategy suitable both for the study of those contents and for passing the evaluation task outlined in point 2 (e.g. theoretical study and guided exercises for solving first-degree equations).

Table 2. Possible relations among objectives, assessment strategies, contents/activities in hybrid solution design and the corresponding involved hybrid dimension(s)

1. Objective	2. Asses-sment	3-4. Contents and Activities	Dimensions of the hybrid solution
Knowledge *Ability to evoke knowledge*	Objective-assessment tests	Classroom lectures and individual study of course contents	
Comprehension *Ability to re-use acquired knowledge*	Subjective-assessment test of re-use	Individual development of a conceptual map which highlights what students consider to be key topics, as well as connections between them; socialization of the various maps and their subsequent classroom discussion	
Application *Ability to re-apply and re-use acquired knowledge to solve new problems*	Problem solving	Individual creation of index for the mini-thesis based on the above representations	
Analysis *Ability to separate the elements, identifying the relations between them*	Assessment of the elements considered and of the analysis conducted on the basis of these elements. Assessment of the arguments used in conducting the analysis	Socialization of the various indexes, group online cross analysis and discussion of indexes in order to identify convergences and divergences	
Synthesis *Ability to combine elements to form a new organised coherent structure*	Assessment of: (a) final product using predefined criteria; (b) transversal skills; (c) active participation	Online discussion aimed at defining a single version of the index agreed on by each group; socialization of the various indexes produced by the groups and teacher-moderated discussion (in the classroom) aimed at agreement on a single version of the index; final synthesis of the various indexes prepared by the various groups	

1. Objective	2. Asses-sment	3-4. Contents and Activities	Dimensions of the hybrid solution
Evaluation *Ability to formulate critical judgments of value and method*	Assessing the arguments on which the critical judgment is based	Development of wikis using a parallel type of collaborative strategy (division of labor), which involves each student developing a section of the overall document. During this activity each co-writer is asked to constantly check the development of the other sections of the wiki, both to avoid repetitions (pages with similar contents) and to identify connections between their own page and those of the co-writers.	
		Once the different sections of the shared document have been written, the co-writers are asked to peer-review all the pages and suggest to their colleagues how to integrate and improve their respective texts *(evaluation)* In this case, the aim is to encourage interaction between the author (the co-writer who generated the page) and the users (all the other co-writers accessing it) on the chosen subject. This interaction is facilitated by the "comments" function associated with each wiki page, through which short dialogues can take place among the different co-authors/users of the hypertext.	

Although this sequence may appear obvious, it does not appear to be widely adopted in practice. At least this is the impression one gets from the all-too-frequent clashes between the way learning activities are proposed and the way they are evaluated (Tremblay et al., 2012).

Table 2 shows examples of some possible combinations of: (1) teaching objectives formulated according to Bloom; (2) related assessment strategy for gauging their achievement; (3-4) onsite and/or online activities to propose to the students.

The column on the right of the table refers to the typical dimensions into which a hybrid solution can be broken down, and which include the activities mentioned in the corresponding lines.

Table 1 refers to the design of a hybrid solution within the "Network Technology and Knowledge Flow" (NT&KF) course at the University of Turin. The aim of the hybrid solution was the collaborative development of an artefact (specifically a wiki) which summarised what had been learned in the study of one of the key topics in the course syllabus (Online Community of Professionals - OCPs). A mixed collaborative strategy was proposed to conduct the learning process, combining:

- a *shared mind* approach (Schrage, 1990) through application of the *pyramid method* (Biuk-Aghai,, 2003) in the study stage and the stage of collaborative planning of the artefact structure;
- a *division of labour* approach in the collaborative writing stage for the actual creation of the wiki.

The scripts (Dillenbourg and Tchounikine, 2007) used in the design of the proposed hybrid solution are presented below as an example.

Table 3. Summary of the script governing the development of the collaborative activity in "shared mind" mode

Activity	Organisation	Resources used
Teacher's Introductory lesson [2h] on study topic with explanation of the methods for carrying out the experiment and of the tools used for data collection.	• Face-to-face intervention and discussion on organisational rules of next step. • Division of students into 8 learning groups of 8-10 members each.	
Stage 1 of the pyramid [5 days]: individual study of material provided by teacher, online search for further material and summary of what they have learnt with structured representation using concept maps.	• Individual activity without interaction with other students except through the module forum moderated by the teacher. • Network activity aimed (a) at integrating the material provided by the teacher with other material from the web, (b) at pinpointing OCPs, classifying them according to some parameters agreed on with the teacher. • Individual development of the map. • Teacher role: waiting for requests (*pull* mode).	• Forum for teacher support on Learning Management System (LMS). • LMS from which to access material uploaded by the teacher. • Any other type of NMT to access other web document resources and the COPs. • A Google Form to collect and classify OCPs intercepted. • Mindomo online editor of concept maps.
Stage 2 of pyramid [2 days]: comparison in pairs of the structured representations and agreement on a single representation.	• Division of each learning group into pairs. • Wholly online activity. • Sharing of individual maps and materials found on the web by each student. • Teacher role: waiting for requests (*pull* mode).	• As above, with addition of any other NMT (synchronous and asynchronous) for interacting 1:1 with one's partner in the pair and for sharing information and documentation (via DropBox, Google Drive, etc.) found on the web by each one during previous step.
Stage 3 of pyramid [3 days]: group comparison in pairs (4-5 groups of pairs for each learning group) of the maps produced by the single pairs and agreement on one map.	• Whole group activity to compare the 4 maps produced by the single pairs. • Online activity for preliminary viewing of the productions of the other 3-4 pairs and first exchange of opinions preparatory to classroom meeting. • Final face-to-face comparison [4h] with the 8 groups operating in parallel. • Teacher role: waiting for requests (*pull* mode). Occasionally *push* in the case of maps with serious conceptual errors.	• As above with addition of any other NMT and web service for group interaction (synchronous and asynchronous) and sharing (via DropBox, Google Drive, etc.) of information and documents found on the web by each member of the group in the previous steps. • NMT continue to be used also during face-to-face group work.

Development of the Index/Structure of the Required Artefact

Table 3 shows a summary of the general script, based on the pyramid method governing the development of the first part of the collaborative task, defined as "shared mind".

Collaborative Development of the Required Artefact

As we said earlier, the concrete goal of the activity was the creation of a wiki by each of the 8 groups involved. For the teacher to have better control of the process, all groups were asked to proceed in the same way in (a) organisation of the group work and (b) the actual writing of the wiki. This activity, developed exclusively online, was divided into 3 steps:

1. a first proposal of an index of topics (8-10 chapters of at least 3 paragraphs each);
2. group discussion of the proposal and agreement on a single version;
3. validation of the index by the teacher, and the sending by him/her of any comments, suggestions and corrections to the single groups. This was to avoid any serious errors which might negatively condition the development of the document.

PBWorks was the environment chosen for the development of the wiki. The *comments box* on the homepage of the wiki under construction was used both for discussion of the index by the group and for the sending of suggestions and corrections by the teacher.

Finally, each member of the group (co-writer) was assigned a chapter of the index from which to develop a branch of the wiki.

Once the different chapters of the shared document had been written, the co-writers were asked to peer-review 2-3 chapters other than their own and suggest to their colleagues how to integrate and improve their respective pages. This type of interaction was again developed within the "comments" box found on every page of PBWorks.

The choice of using a wiki to support the collaborative writing is justified by the various possibilities this tool offers for observing and tracing students' activities (versioning of the pages; discussion in the "comments" box or associated forum; tagging; creation of reticular link structures, etc.). These possibilities can be effectively exploited for monitoring and assessment, not only of the final product, but also of the process which has led to its production, and of the level of participation and active contribution of the single members of the work group (Judd et al., 2010; Trentin, 2010).

CONCLUSION

NMTs are being used more and more as habitual tools of communication, expression and socialization, and not only by the new generations. Their intensive penetration into every context and moment of daily life obliges us to meditate deeply on the role these technological resources already play and will increasingly play in any real process of sustainable didactic/pedagogical innovation.

In this context, universities too cannot remain indifferent to the changes in communication and social interaction produced by the combination of the mobile technology everyone carries with them (BYOD) and that provided by the web (social media and, more

generally, cloud technology). These changes demand radical rethinking of teaching/learning models and adaptation of educational management/organization to new spaces; spaces which are characterised by the spontaneous hybridization of real and virtual environments (HLS).

This urgent demand for renewal often starts from the base, from the student user which is used to a communicative dimension that systematically integrates face-to-face and mediated interaction, and expects to find the same situation in institutional teaching/learning processes.

An important step towards real didactic/pedagogical innovation which exploits the potential of the new technologies would be to achieve thorough understanding of "why" and "how" they should be used, potentiating and improving teaching/learning processes in the light of the new ways of communicating and acquiring knowledge which they have introduced into everyday life. This can only be achieved through closer-knit mutual "contamination" between technology and pedagogy, a contamination which is beginning to be seen today in the availability of new, more sophisticated media which have opened up new perspectives and applications for participational and productive pedagogy based on learning-by-doing.

In this scenario, it is inevitably the teachers who must become the activators of a process of didactic innovation which takes into account the multiplicity of information and interaction channels which the students have at their disposal daily.

This implies a change in both the teacher's role and didactic organization. An "epoch-making" change which requires the teacher to "learn to teach" (a) in a different way from which she/he was trained to do; (b) in hybrid learning spaces (HLS) and (c) with pedagogical approaches which exploit the specific opportunities offered by these HLS.

The chapter has thus focused on the pedagogical, teaching and instructional design aspects of an educational process which is destined to develop more and more in HLS. From the specific *pedagogical* point of view it is pointed out how consolidated theories inspired by learning-by-doing pedagogy and networked collaborative learning can now be developed in an ideal context, the hybrid space, which is much closer to the natural behavior and way of communicating of the new generations. At the same time, the role of the teacher is re-examined, placing more emphasis on their role as facilitator rather than as director of the learning process.

From the *didactic* point of view, we underline that the use of HLS implies the need to find equally hybrid solutions/strategies for managing the teaching/learning process, based on carefully thought-out combinations of sites for developing the learning process (onsite/online) and learning dynamics (individual/collaborative).

Finally, the need for careful definition of the third essential element which binds the two previous elements together, i.e. instructional design, has been discussed. It has been seen that pedagogical strategies in line with the HLS concept can be created and applied through a careful process of instructional design where scripting cannot be separated from the planning of the step-by-step assessment for understanding (a) if and how we are actually moving towards the declared learning goals and (b) the contribution of individual students to the collaborative process which develops within the learning groups.

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