The Effectiveness of Hybrid Solutions in Higher Education: A Call for Hybrid-Teaching Instructional Design

Draft version of:

Trentin, G. and Bocconi. S. (2014). The Effectiveness of Hybrid Solutions in Higher Education: A Call for Hybrid-Teaching Instructional Design. *Educational Technology*, 54(5), 12-21.

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Abstract

In order to design learning solutions that effectively embed face-to-face and online dimensions, it is crucial to identify the key components underpinning hybrid solutions.

Furthermore, once these components have been identified, there is the need to clarify how to recombine them to meet a specific learning objective.

The paper aims to highlight the role of network and mobile technologies (NMTs)[1] in enhancing the particular characteristics of hybrid solutions (HS) with a view to (a) potentiating/enriching the teaching/learning processes, (b) exploiting the varied opportunities it offers for their observability, and hence for their monitoring addressed to formative and summative assessment.

The article will emphasize how this potential can only be captured by solidly integrating the process of teaching/learning design with that of monitoring and assessment.

After a brief overview of hybrid solutions in higher education, a possible breakdown of HS into its key dimensions (onsite/online/individual/collaborative learning) will be proposed. The aims is to understand how the characteristics of those dimensions can be used to enrich/potentiate both the teaching/learning and the assessment processes. The role of NMTs in supporting and fully exploiting the special features of HS will be explored using concrete examples. The third part of the article will address the question of how to combine and/or use singly the various components of HS, providing guidelines for applying the HS dimensions to

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[1]. In this article, the term “NMTs” it is not only referred to the communication technologies but also to the web resources accessible using them (e.g. social media, instant messaging, etc.).

the specific goals of the teaching path and to the activities which are functional to the achievement of learning goals.

To conclude, the emerging contexts and evolutionary models of Massive Online Open Courses (MOOCs) will be discussed as an example in line with the proposed HS model.

Keywords: hybrid learning; network and mobile technologies; assessment; collaborative learning; instructional design; university teaching.

Overview of Hybrid Solutions in Higher Education

Hybrid learning models in university course delivery have grown rapidly over the last decade (Dziuban, Moskal, Kramer, & Thompson, 2013). Although discussion of the meaning of the term “hybrid learning” (often used interchangeably with "blended learning") is still ongoing (Kaleta, Skibba, & Joosten, 2007; Millichap & Vogt, 2012), there seems to be widespread agreement that blended learning mainly involves a combination of face-to-face and online activities (e.g. Stacey & Gerbic, 2008; Graham & Dziuban, 2008). Although a broader application and integration of several other blending options (e.g. blending of synchronous and a-synchronous communication, of instructional formats, etc.) would be useful for making informed decisions, from a pedagogical standpoint, a deeper understanding of grounded practices is key to ensuring the quality and effectiveness of hybrid learning environments. Peter Shea (2007) proposed a grounded model for blended or hybrid learning environment, which entails 5 main levels:

(1) stating *assumptions* and *beliefs* about the nature of knowledge;
(2) identifying the *theories of learning* that reflect these beliefs;
(3) specifying the *pedagogical models* that attempt to bridge theory and practice;
(4) defining *instructional strategies* that provide general guidance for particular learners in particular contexts;
(5) designing specific *learning activities* that achieve the goals.

Examining and communicating what we know, believe, or choose at each of these levels will provide guidance that helps accommodate each of the elements that may be blended (ibid, p. 31).

Several authors also focus on quality implications (e.g. Smythe, 2012), highlighting the transformational potential of hybrid solutions. For example, Trentin and Wheeler’s

(2009) definition is concerned with improving the overall pedagogical quality within a planned strategy that is needed to effectively integrate online with traditional face-to-face activities. Kaleta, Skibba, and Joosten (2007) examined faculty experiences in discovering, designing, and delivering hybrid courses and identified that major factors affecting the decision to adopt hybrid courses were including how faculty development can be used as a change agent.

In order for hybrid solutions to encourage innovative educational practices and meaningful learning, these should be designed to support collaborative, learner-centered instruction, as well as embedded assessment for learning. Kali and colleagues (2007), for instance, explored the learning taking place in three hybrid university courses in education and argued that three main design principles should be employed: (a) engaging learners in peer instruction, (b) involving learners in assessment processes, and (c) reusing student artifacts as resource for further learning.

The present article aims to explore the roles of NMTs in facilitating the emergence of new hybrid solutions in higher education looking into grounded experiences of hybridization of *learning processes* (individual and collaborative) and *spaces* (onsite and online), where learning flows across formal (classroom) and informal (extra-classroom) settings.

Key dimensions of Hybrid Solutions in university teaching

In university teaching there are various ways of seeing HSs (e.g. Graham, Woodfield & Harrison, 2013). The reason for this lies in the concept of "hybrid", i.e. the mixing of different teaching approaches in the most varied of combinations when proposing learning activities aimed at achieving of one or more educational goals. Although the aspect of HS 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 HSs is used to cover a mixture of various teaching approaches, either exclusively face-to-face or distance teaching or a combination of the two.

In this article, instead of emphasizing the alternation of face-to-face and distance learning, and in order to underline the role of network and mobile technologies (NMTs) in enhancing the particular characteristics of HSs, the "onsite/online" learning terms are used to refer to the learning process which takes place respectively *onsite,* in a physical space (a classroom lecture, a collaborative laboratory activity, study in the library or at home), as well as *online,* 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 space between an onsite activity and the next one, but it may extend over a much wider timespan, being conducted in parallel to several face-to-face activities.

Figure 1 shows hybrid solution developing along three main dimensions, namely the *learning process* (collaborative, individual), the *settings* (classroom, extra-classroom) and the *learning space* (onsite, online), creating a fluid, organic continuum that is the learning path.

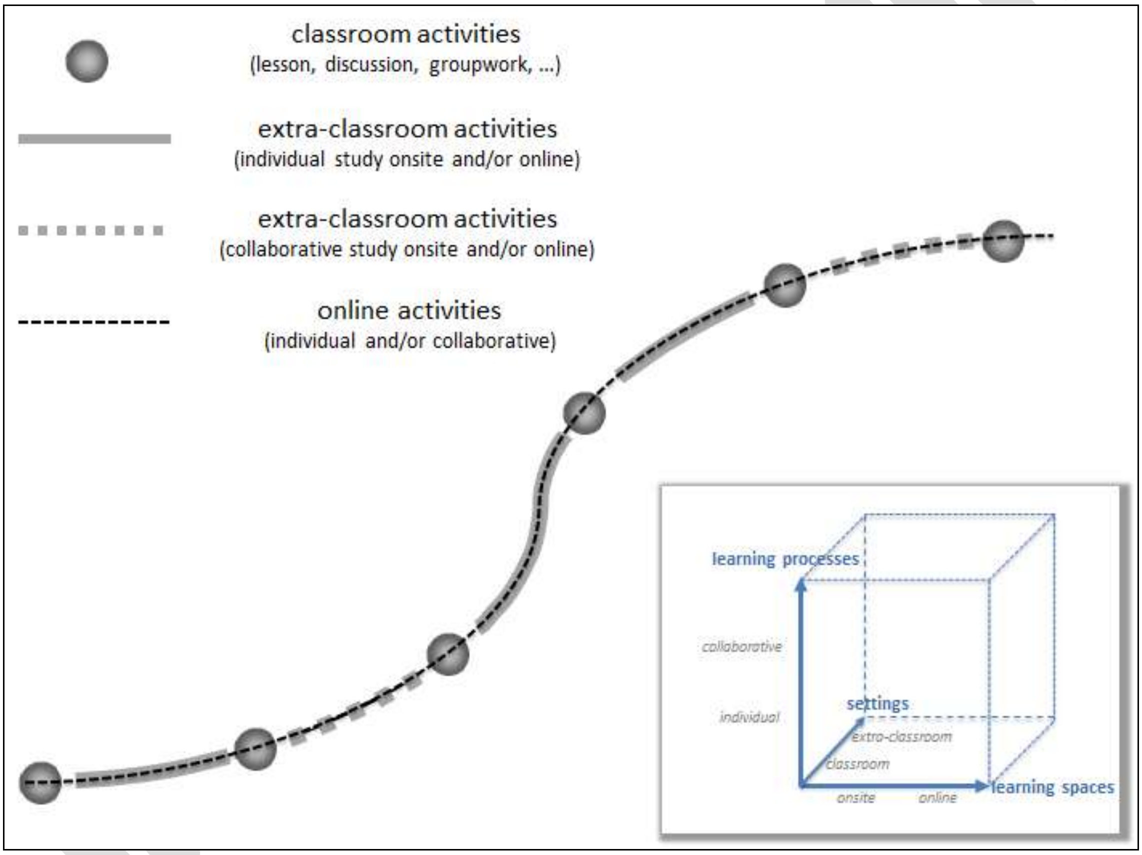


Figure 1. Mixing online and onsite activities in classroom and extra-classroom settings.

Hence, the balance between *online* and *onsite* learning activities in a HS can vary considerably, strongly depending on the pedagogical setting. In fact, the creation of a HS must be based not only on an adequate integration of teaching methods and tools, but also on pedagogical consideration to complementary dose of onsite and online components. In other words, onsite activities must help lay the foundations for a more effective development of the subsequent online activities, clarifying 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, 2010).

In order to understand how HS specific characteristics can be exploited in higher education settings, a matrix can be formalized by using the following two main dimensions: 1) *onsite/online learning* and 2) *individual/collaborative learning*. These two dimensions are combined to form four quadrants in defining hybrid solutions, each with specific types of situations designed for enriching both the teaching/learning and the assessment processes with the support of NMTs (Figure 2) (Bocconi & Trentin, 2014):

1. onsite-individual learning;
2. online-individual learning;
3. online-collaborative learning;
4. onsite- collaborative learning.

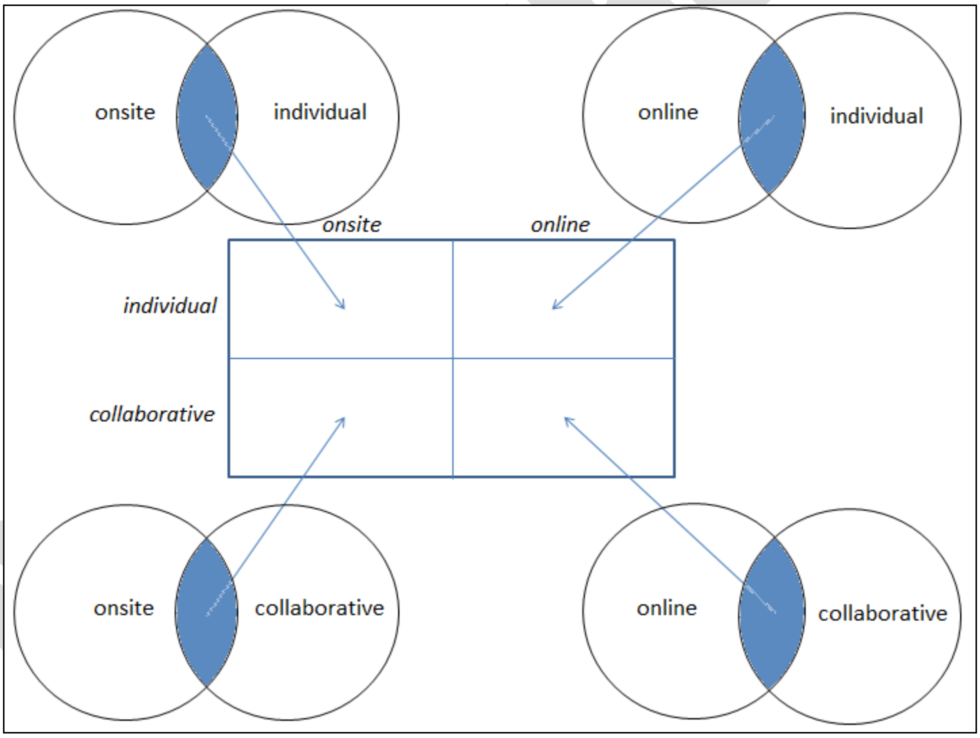


Figure 2. Matrix of the key dimensions of HSs.

This first 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, thus improving and expanding opportunities for exchanging knowledge and contents. For example, mobile technology can be used by the teacher to collect on-the-spot students' 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, as well as to optimize both range and time, gathering a wider set of data, overcoming the limitations of traditional onsite-individual learning settings (e.g. help to detect individual learning needs in large face-to-face classrooms).

The second 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 point of view of learning, 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). As part of assessment, NMTs offer to 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.

The third 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 NMTs uses facilitating online interactions and collaboration among individuals. From a learning point of view, NMTs not only support and improve students' online collaboration, but also increase students' self-help dynamics, by amplifying groups'/individuals' reciprocal interactions for supporting one another in the application of what they have learnt, for socializing problems, and most of all for sharing solutions and strategies for the use of the new acquired knowledge. As part of summative assessment, network technologies can improve university teachers' opportunities to monitor and assess three key aspects of collaborative learning: students' *collaboration process*; group *final product*; and individual students' *learning outcomes* (e.g. Swan, Shen & Hiltz, 2006). Objective data automatically traced by NMTs (e.g. number of messages, network analysis views of social relationships) can be combined with subjective data (teachers' evaluation, peer evaluation conducted inside the learning community), thus allowing conclusions to be drawn about the collaborative process, regarding both the individual student's and the group's contribution to the community (Trentin, 2009; Bocconi, 2012).

Finally, the fourth 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 knowledge exchange at group level, thus moving communication and collaboration outcomes out of the physical-local context in which collaborative learning takes actually 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 to return immediate feedback to students' group discussions. For instance, network technology allows a real-time Delphi-like approach, facilitating teachers' real-time calculations and visualization of students' replies. In the process of completing this group task, students are invited to reflect upon a proposed concept/problem and send their own definition/solution 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. NMTs allow adoption of similar approaches even in large classes, where they can also be used as warm-up activities to force students to think through the arguments being developed, increasing their engagement and active participation in peer instruction processes (Smith et al., 2009).

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* components, NMTs provide the "*learning space*" where the learning process actually takes place. The common theme thus emerging from the analysis of each quadrant of the proposed HS framework is the need to consider what pedagogical practices are made possible by the use of NMTs, in order to adequately conceive and design the bridge between *learning spaces* and *learning approaches* and thus move towards a structured and sustainable hybrid learning solution.

Guidelines for designing and applying HS dimensions in university teaching

After having broken down the HS model proposed in this article into its various dimensions, in this section we imagine the reverse procedure, i.e. different ways of recombining these components into a HS, adapting them each time to both the chosen teaching/learning and formative or summative assessment processes.

It should immediately be pointed out that these two processes (teaching/learning and assessment) must necessarily interact with each other. In other words, when planning the teaching activity there is the need to make sure that the path to be followed by the students is 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: the individual student (e.g. levels of learning, of active contribution to group work etc.); the products developed during the proposed activities (artifacts, problem-solving, exercises etc.); 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, their way of arguing their opinions and/or their 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" it is meant any activity that leave "digital traces" which can be analyzed 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.

At this point, it is clear that the instructional design phase cannot be separated from that of the monitoring system (and more generally of the assessment process), in order to fully exploit the possibilities offered by the observability and traceability of the students' actions for the assessment of either the learning process or the HS itself.

So in planning a HS, 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 which is functional to the assessment, then construct the teaching activity in such a way as to favor the collection of the data and information which will feed said system.

This is the approach in fact followed in the "Polaris" instructional design methodology (Trentin, 2001; 2010), developed within the project of that name for the online training of school teachers, 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; from this, the ways of assessing their achievement are first derived, then the teaching activities are structured so as to create the above-mentioned observable and traceable path.

Learning objectives correspond to 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 hint at 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 (Trentin, 2001).

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).

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 3).

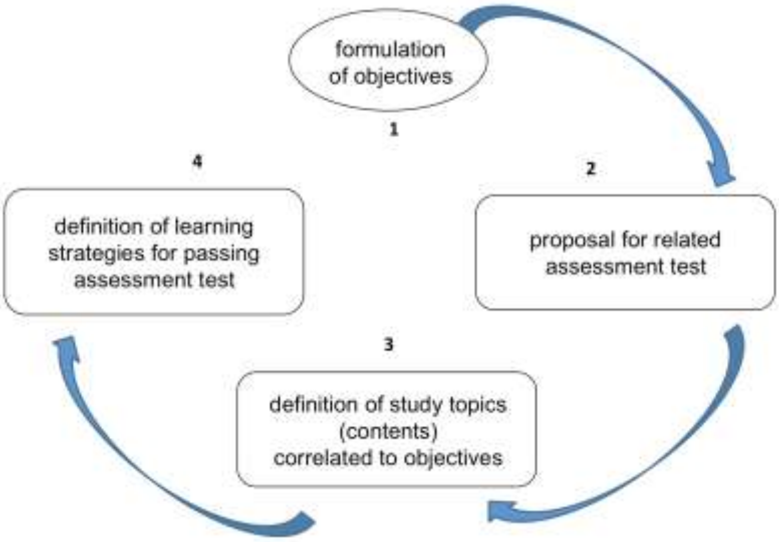


Figure 3. Formulation of objectives as a reference point in instructional design.

As shown in Figure 3, the logical sequence should be as follows:

(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).

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.

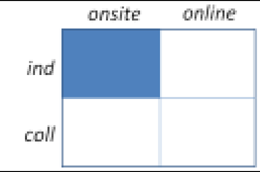
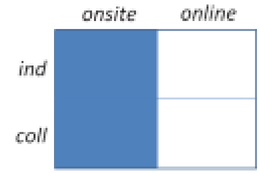
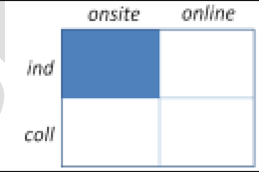
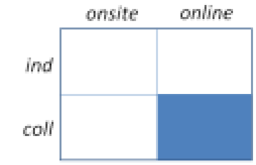
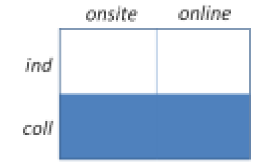
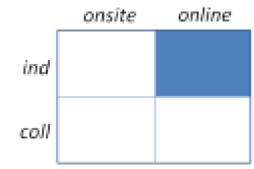
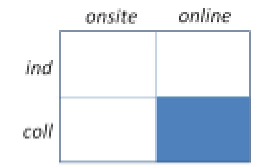
Table 1 shows examples of some possible combinations of: (1) teaching objectives formulated according to Bloom; (2) annexed assessment modality, for gauging their achievement; (3-4) onsite and/or online activities to propose to the students.

The example, in particular, is referred to the design of an HS within the "Network Technology and Knowledge Flow" (NT&KF) course at the University of Turin (Trentin, 2007). The aim of the HS was the collaborative development of a synthetic document (i.e. final product) on the theme of NT&KF, a kind of mini-thesis aimed at helping students prepare the final exam.

The right-most column of the Table 1 shows the dimensions of the HS model here earlier described, into which the various activities fall.

The choice of using a wiki to support the HS described above is justified by the various possibilities that 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 to carry out activities of 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 (Trentin, 2009; 2013).

Table 1. Possible relations among objectives, assessment strategies, contents/activities in HS design and the corresponding involved dimension(s) of the HS model earlier described (figure 1).

1. Objective	**2. Assessment**	**3-4. Contents and Activities**	**Dimensions of the HS model**
Knowledge *Ability to evoke knowledge*	Objective-assessment tests	Classroom lectures and individual study of NT&KF 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	
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.	

MOOCs as an example of the proposed HS model

Recent Massive Open Online Courses (MOOCs), which integrate onsite and online, individual and collaborative, are an example in line with the proposed HS model.

In MOOCs, students mainly learn by making connections among media-rich resource pools and by communicating and collaborating with others (Downes, 2013). All the HS dimensions discussed in the present contribution are in place.

In the novel MOOC contexts, NMTs offer a twofold opportunity to improve university: on the one hand, the creation and development of media-rich contents, such as micro-videos that address multimodal communication strategies (e.g. creating presentations with the text in front and the video in background) and the integration of interactive sections to actively engage students. In creating these educational materials, teachers refine contents for accuracy and fluidity, thus improving the efficacy and cognizance of educational resources that support *onsite-individual* learning. On the other hand, given the large number of MOOC participants, teachers’ strategies for monitoring and managing learning interactions also change towards more “distributed” and peer-instruction teaching (Crouch & Mazur, 2001), scaffolding students’ participation.

From a learning perspective, NMTs in MOOC settings amplify two key aspects of collaborative learning practices: *students’ peer-assessment abilities* and *self-help dynamics*. Due to the impossibility of teachers’ evaluating and assessing complex, open-ended assignments for courses with tens or hundreds of thousands of students, peer grading strategies are adopted in MOOCs to provide students with on-time and adequate feedback; by reviewing peers’ work (usually following review criteria and grids provided by teachers), university students not only learn to identify critical and positive elements, but also improve self-assessment abilities. Additionally, while in traditional (and closed-community) online courses, collaboration mainly focuses on collaborative production of project artifacts, in the MOOC online format collaboration is mainly encouraged through students’ self-assistance practices (Hill, 2012).

Finally, along with the learning needs arising from the newest pedagogical settings like MOOCS, the proposed model brings HSs in line with students' real current NMT uses, by mixing the different components to form a continuum which shifts between individual and collaborative, online and onsite learning.

Conclusion

This article has proposed a possible approach for the modelling of hybrid solutions centered on the use of NMTs and aimed at improving teaching, learning and assessment processes in higher education.

Two elements are held to be essential for the effective application of the proposed model:

1) *good design* of the hybrid solution, taking into account the particular features of each component and adapting them to the stated learning objectives;
2) teachers' awareness of their changing role in the *management of the hybrid-instructional process*.

Regarding the first point, skill in designing the HS, this implies finding the right mix among possible components, thus effectively combining a number of teaching approaches that can be formal and informal, directive and discovery-oriented, based on technology and social interaction, and on online and onsite collaboration. To this end, it is therefore beneficial to start out with a clear definition of the educational objectives and then identify the most effective teaching activities and strategies for achieving each of them in turn.

Accordingly, a fundamental recommendation is to adopt instructional design criteria oriented which are towards HS, and which at the same time integrate approaches for 'designing classroom activities' with those for 'designing network-based education' (NBE), also taking into account the specificities, potentiality and criticality of the technological media intended to be used (McCracken & Dobson, 2004). For example, during course planning a good balance should be guaranteed between onsite activities (face-to-face lectures, laboratory, discussion regarding occurrences online, etc.) and online activities (individual study, group activity, etc.), in such a way that each one is functional to the others.

However, in university education, it is very often noticeable that teachers are unfamiliar with instructional design in general (Fill, 2006). Indeed, teachers are by nature primarily experts in their subject and their pedagogy is generally “spontaneous” and related to their direct experience, refining their own style of managing the learning/teaching process. Although this “spontaneity” may even be acceptable in classroom teaching, the adoption of hybrid approaches automatically entails teachers acquiring the fundamental notions of instructional design.

In this way they can plan the most effective blend of approaches to achieve the stated learning objective, using both technology mediation and face-to-face interaction. This does not imply that adopting a hybrid approach requires teachers to become professional instructional designers, because they will still be required to be experts and teachers in their field. Nevertheless, if teachers are prepared to undertake the design, development and running of hybrid-type teaching activities, there will be greater improvement in the quality standard of the corresponding learning/teaching processes.

This leads to the second essential element mentioned at the beginning of this section, that is raising teachers’ awareness of their changing role (Trentin, 2013), from teaching to *h-teaching.* In order to integrate HSs into their teaching practices, teachers must change their attitude to teaching, shifting from a vertical model of knowledge transmission to a more horizontal one, based on collaborative processes as well as individual study. The teacher’s role continues to be a central one, even if it is now rather as facilitator of the process than as mere dispenser of knowledge.

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