Beyond the discipline: A metadisciplinary approach for the didactics of communication design

Giampero Dalai, Berta Martini, Luciano Perondi, Monica Tombolato

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Abstract

We reflect specifically on the curriculum for bachelor's level program in communication design. We propose a model of education which we define as "metadisciplinary" and which is grounded on the acquisition of competences rather than the acquisition of specific contents. Our objective is to show how a metadisciplinary didactic model can benefit from the weak epistemological status of the knowledge base of communication design. According to the idea that didactics can be treated as a science of design, we propose a model of educational design based on a metadisciplinary stance. First we describe two fundamental aspects of the model proposed: (1) the development of *habitus* of thought and action and (2) the distributed and collective nature of expert knowledge. Next, we discuss the notion of curriculum architecture. Finally, we describe a basic set of metadisciplinary competences that we have identified for students in the field of communication design.

Key words

Didactics, Teaching of communication design, Curriculum development, Learning outcomes, Professional social practices

Resumen

En el artículo que presentamos, reflexionamos específicamente sobre el currículum para programas de grado en diseño de comunicación. Proponemos un modelo educativo que definimos "metadisciplinario", basado en las habilidades que deben ser adquiridas por los estudiantes, en lugar de contenidos específicos. Nuestro objetivo es analizar cómo un modelo de enseñanza metadisciplinario puede beneficiarse del débil estatus epistemológico del diseño de la comunicación. Según la idea de que la Didáctica puede considerarse una ciencia del diseño, proponemos un modelo de planificación educativa orientado al desarrollo de actitudes metadisciplinares. En primer lugar se describen los aspectos fundamentales del modelo propuesto: el desarrollo del *habitus* de pensamiento y acción; el conocimiento experto como conocimiento distribuido y colectivo. A continuación, se analiza la arquitectura del currículum; finalmente, se indican las habilidades básicas del recorrido formativo que el equipo de trabajo ha seleccionado a partir de las prácticas reconocidas en el campo del diseño de la comunicación.

Palabras clave
Didactica, Enseñanza del diseño de la comunicación, desarrollo curricular, resultados de aprendizaje, prácticas sociales profesionales

1. Introduccion

Any program of study in a given field must distinguish between two distinct forms of knowledge: *savoir savant* and *savoir à enseigner*. This means that educators must deconstruct the *savoir savant* in order to identify its essential components (Martini, 2005) and, eventually, to reconstruct a *text du savoir* Chevallard, 1991). The *text du savoir* allows students to acquire the knowledge and skills necessary for acting effectively in the field of study.

When the field of study is intrinsically interdisciplinary, the *savoir savant* emerges from the intersection of disciplines with different epistemological statuses, which can be "weak" or "strong." In this case, the *savoir à enseigner* of the field needs to include the essential components of the disciplines involved. In this article we propose a didactics of communication design that moves beyond a discipline-oriented model. This approach interprets the term "didactics" not only as the theory of teaching, but also as a science of design (Laurillard, 2012).

1.1. The teaching of communication design

This article draws inspiration from the development of a joint course in editorial design at Istituto Superiore per le Industrie Artistiche (ISIA) Urbino and at the University of Urbino (Luciano Perondi, Beppe Chia, Leonardo Romei, Berta Martini, Paolo Polidori, Yuri Kazepov, and Luciano Angelini); from collaborative teaching and other work done at the Centro Internazionale di Studi Interculturali di Semiotica e Morfologia (CISISM, Berta Martini and Luciano Perondi); and from the work involved in overseeing teaching and curriculum development for the Bachelor's in Graphic Design and Visual Communication of ISIA Urbino (Luciano Perondi).

In this article we reflect specifically on the curriculum for bachelor's level programs in communication design, regardless of the type of institution or the duration of the program (three or four years). In particular, we propose a model of education that we define as "metadisciplinary" and that is based on competences to be acquired rather than on specific contents to be learned.

A curriculum designed in this way could increase the value of communication design as a field of research and also increase its political usefulness and practical applications. Its increase in value would be related not only to the specific uses of communication design, but also to the fact that this research field would become fundamental to other disciplines, which in turn could increase their production as a result of their relationship with communication design.

The field of graphic design, or by greater extension of communication design, can be considered to have "weak" epistemological status because it does not have particularly complex specific disciplinary contents if compared to disciplines with strong status, such as physics or medicine, which are considered to have "strong" epistemological status. By the locution "specific disciplinary contents," we mean the basic knowledge a student must learn before being able to approach a problem within the domain defined by the discipline. For example, unlike in physics or medicine, in graphic design this is usually possible at the end of the first year of the bachelor's or even earlier.

The specific skills of graphic design are:

1) graphic composition / visual configuration, including micro and macro typography, editorial design, graphic design, brand identity
2) design methodology

Neither of these skills has developed a solid scientific grounding yet.
The remaining skills involved in graphic design are borrowed from other disciplines, for example:

1) history (of graphic design)
2) neuroscience (perception and cognition)
3) drawing
4) photography
5) etc.

or from a mix of disciplines, such as color theory, which draws from physics and neuroscience.

Indeed, as Potter (2002, p.100) highlights, "Much design work is carried out in a very direct and informal way. [...] Of course an artisan designer (of any kind) works very directly and with a minimum of 'communication procedures'. [...] The procedures show the designer approaching an unknown situation, making himself familiar with it, taking instructions, making sure they are fully understood, weighing the possibilities, discussing them, arriving at conclusions, offering proposals, modifying them, providing drawings and other instructions to a third party, and supervising the outcome.The result is something new in the world; a product, an environmental change; a new set of possibilities."

1.2. The bottom-up genesis of design as a discipline

The weak epistemological status of communication design is due, at least partially, to the bottom-up genesis of the discipline. Indeed, this field of study took form progressively, starting from a body of knowledge organized in a non-systematic way by a community of professionals, with the objective of tackling multidimensional, broad problems (Morin, 1999). The multidimensional nature of the problems means that designers must master not only knowledge belonging to different cognitive domains (that is, to different fields of experience characteristic of different fields of study), but also the competence to combine and transfer that knowledge. In short, they must use a metadisciplinary approach.

1.3. The strength of the weak status of communication design

In order to build a body of professional knowledge with pieces of information that are not fully structured and formalized yet, we must build educational pathways based on principles of didactic design. The weak epistemological status of communication design grants a significant didactic advantage, since it allows the students to work on realistic projects earlier than students from disciplines with strong epistemological status. For example, in physics, engineering or medicine, students need several years of background studies before being able to carry out projects in their field. This contrast between students working in fields with weak vs. strong epistemological was evident when ISIA Urbino and Università degli studi di Urbino organized mixed courses in 2013-2016 in which communication design was combined with disciplines with stronger status, such as sociology, pedagogy, and the normative discipline of law.

Moreover, the simplicity and the specificity of the background of communication design allows students to focus not only on curricular competences but also on integrative ones (see Section 4).The set of competences acquired by the end of the could be applied in professional contexts not strictly bound to the main subject of the course (i.e. graphic design, as well as areas such as industrial design and interaction design).

We do not provide a definition of communication design as a self-contained discipline. Numerous authors and institutions have defined “design” or “designer” (such as Potter, 2002; World Design Organization, 2015) and mapped the subdisciplines (such as Saffer, 2009, pp. 20-22; Carta del progetto grafico, 1989; Farrell and Nielsen, 2014), including several “communication” subdisciplines. Rather than focusing on disciplinary definitions, our objective is to discuss how a metadisciplinary didactic model can benefit from the weak epistemological status of communication design.

The weak epipstemological status of communication design and its implicit multidisciplinarity mean that we cannot consider communication design (or design more broadly) to be a clearly defined and bounded discipline (Rodgers and Bremner, 2017). Rather, the straightforwardness of the theoretical background of communication design means that students—from very early in the study program—can use it in applied projects that include contents from other disciplines. Mixing students from different disciplines and levels in the same class allows students to take advantage of the transdisciplinarity of the theoretical base of communication design. This approach benefits communication design students by enriching their theoretical background and benefits students from other disciplines, by allowing them to apply their theoretical knowledge to realistic projects at the beginning of their studies. This context should help students develop the skills of resilience and ductility (see Sections 2 and 3) considered primary in the methodology of communication design.

2. Metadisciplinary didactics and curriculum design

The idea that didactics can be treated as a science of design arises from the need to face the complexity of educational situations and their resistance to experimental control (Laurillard, 2012). When an educational innovation is implemented, the result can be very different from the planned design. This is due to the unpredictability of teaching situations. The solution is to adopt a design-based methodology, which is not experimental in a traditional sense but rather iterative. In this way, any educational innovation, which is initially based on theory, can be revised in light of what has occurred in the classroom. This approach makes it is possible to improve both theoretical knowledge and practical knowledge (Collins, 1999).

The teaching model we propose here is a design experiment with several starting premises:

- The complexity of teaching situations (teaching does not occur in a laboratory, but rather in a changing context with many inherent uncertainties)
- The flexibility of the design (the initial project develops gradually through a process of revision)
- Social interaction (the initial project develops on the basis of a feedback system between researchers, teachers and students)
- The goal of the experiment is not to confirm hypotheses but rather to develop and refine an educational pathway

An educational design experiment is therefore a reflection-in-action (Schön, 1983). This idea originates in Dewey's theory of inquiry (1938). According to Dewey, every inquiry that takes place develops from the indeterminacy of the situation to its resolution. Those who perform an inquiry combine mental reasoning and action in a process that is transactional, indeterminate and intrinsically social. As a result, we have forms of practical inquiry that lead to the invention of possible paths of action that do not fall within the prevailing scheme of practical reasoning. That is, the path of action is not selected from a set of pre-established options.

Within this framework, we define *metadisciplinary didactics* as a model of educational design oriented to the development of metadisciplinary attitudes, which allow people to recognize and transcend the boundaries of their discipline and communicate and work as a team with specialists from disciplines different from their own (Minghetti and Cutrano, 2004).

This definition captures two fundamental aspects of educational design:

1) The development of metadisciplinary attitudes fosters the acquisition of the *habitus* (of thought and action) of the communication designer
2) Expert knowledge is inherently collective and distributed in that it implies a progressive specialization of cognitive work, which emerges through collaboration (Sloman & Fernbach, 2018)

2.1. The development of competence

With regard to point 1, we first specify the meaning of the concept of *habitus*, then clarify its relationship to the concept of competence. Bourdieu (2003) defines *habitus* as the set of durable and transposable internal dispositions that guide the subject and serve as a matrix of perceptions, evaluations and actions within a domain. In the domain of science (2003a) practitioners must not only master the relevant theoretical background but also develop a *habitus* that allows theory to flow into their practice in the form of "craft", "dexterity", "glance." In other words, performing competently within a certain domain of knowledge requires both *knowing how to think and knowing how to act* (Martini, 2017).

Moreover, this domain specificity is not only specificity of contents, but also epistemic specificity. This means characterizing a field of knowledge not only in terms of its contents, but also in terms of its established rules of use, methods and languages, which together ensure the generation of products belonging to that particular domain. It is then possible to identify a relationship between the process of acquiring competence in a certain cognitive domain and the process of structuring the corresponding *habitus*. According to Bourdieu, the *habitus* is constructed through repeated exposure to domain-specific practices. This means that working in a certain domain allows us to gain progressively more confidence with its practices; that is, to know how to act effectively and efficiently within it.

According to a certain cognitive perspective of learning, knowing how to act cognitively in conformity with a disciplinary domain implies constructing relevant and effective *action patterns* with respect to that domain (Vergnaud, 1994). *Action patterns* are invariant structures that can be mobilized in different situations. Broader and more complex *action patterns* for handling more complex situations can be obtained by assembling basic ones. As a*ction patterns*, as in *habitus*, they are developed in practice and improved by the student through repeated and extensive exercise.

From an educational standpoint, it is therefore reasonable to consider certain sets of domain-specific activities—which stimulate directly, frequently and systematically certain modes of thinking and acting—as the experiential contexts of the domain-specific development of these schemes. In this perspective, the specific way of thinking and acting that characterizes a certain domain of knowledge can be assimilated to the specificity of the practices that lead to a certain *habitus* or converge in a certain "practical sense." By this we do not mean that disciplinary competence and *habitus* are the same. Rather, we argue that it is possible to think of the process of acquiring knowledge as a process of incoporating of the corresponding *habitus*.

We use the term "competence" to refer to the ability of the subject to coordinate his/her declarative knowledge (*know that,* notions) and procedural knowledge (*know how*, skills) together with the proper internal dispositions to face a challenging situation (Pellerey, 2003). The internal dispositions are systems of beliefs, motivations and values that orient and influence the behavior of the subject. According to this definition, a subject shows competence when he/she intentionally employs declarative and/or procedural knowledge to deal with new problematic situations.

This definition of competence is useful for our argument because it interprets competences as "knowledge in use" and highlights their transversal nature (Martini, 2009). Competence is something that transcends one's declarative and procedural knowledge and allows one to act intentionally by taking responsibility for one's own doing (Le Boterf, 1997). Behind every performance in a specific context there is a competence "at work." Competence, however, does not coincide with performance. A set of performances is not just a series of disjointed facts. Rather, competence indicates an ability to combine various behaviors and transfer them to other relevant situations. More precisely, competence is an attribute of the subject-in-situation (Frega, 2012).

According to this view, competence is a higher level of learning than the learning of knowledge and skills, as it results from the adaptive combination of these forms of knowledge. Another important aspect is that this higher-level learning develops in parallel with lower-level learning. From an educational point of view, this means that competences must be developed simultaneously with other learning. This process requires tasks of different difficulty level, according to the levels of mastery of declarative and procedural knowledge (Baldacci, 2006).

These tasks fulfill the role of Kuhnian exemplary cases (Kuhn, 1969), which have the function of training the subject to recognize similarity—under some respects—as a necessary requisite for transfer. In other words, domain-specific knowledge and skills (i.e. acquired in a specific cognitive domain) become transversal when the subject uses them intentionally in situations that are different from those in which these knowledge and skills were acquired. This happens because the subject identifies a similarity in some respects between these situations.

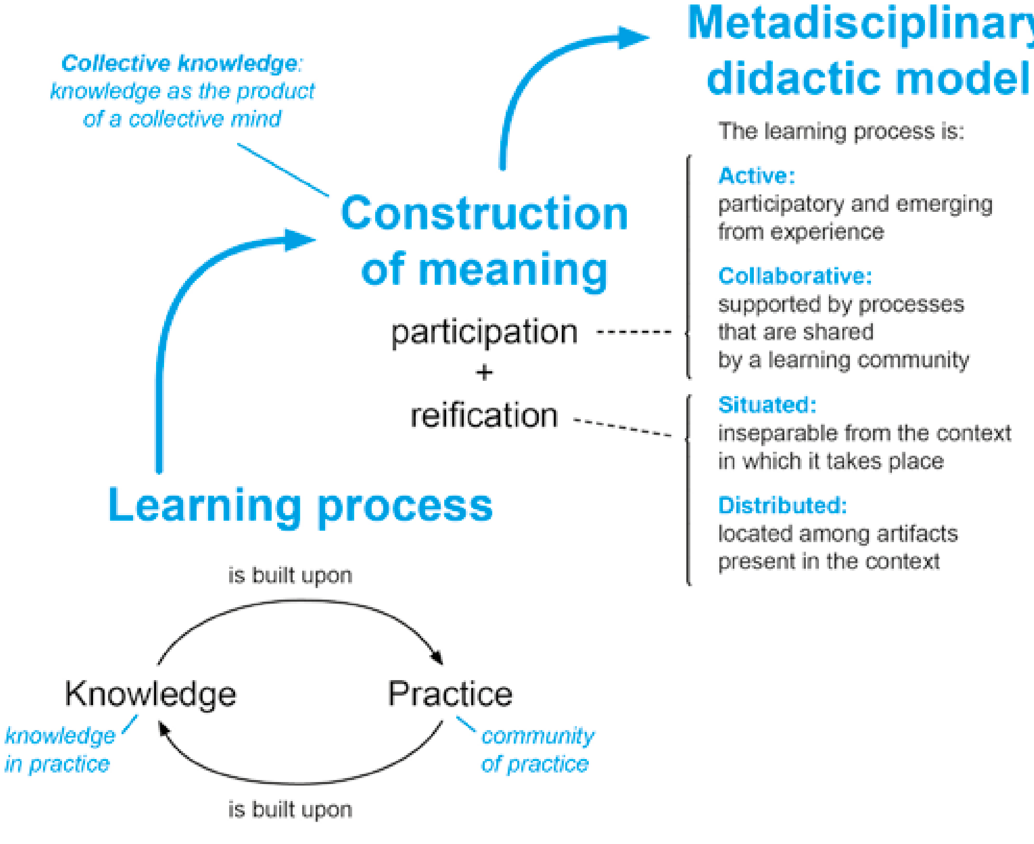
The ability to transfer knowledge is therefore in the “eyes” of the subject who *sees* the new situation *as* (Wittgenstein, 1953) analogous—in some respects—to known situations. These situations indeed play the role of paradigmatic situations (Kuhn’s exemplar cases). Therefore, the process of transferring knowledge to new contexts is difficult not because of objective factors independent of the subject. On the contrary, the difficulty is linked to the subject’s ability to perceive the analogy between two different contexts, which can stimulate the use of the same knowledge and skills. In short, metadisciplinary attitudes imply the ability to act effectively in contexts. Effective action takes place, from an epistemological point of view, thanks to the incorporation of *habitus*, and, from a psychological point of view, thanks to the construction of schemes of action.

2.2. Collective knowledge

With regard to point 2, adopting a metadisciplinary didactic model requires adhering to a specific learning model. The complex, uncertain and intrinsically social character of didactic situations has led us to interpret the processes of gaining knowledge with a socio-constructivist approach, through which learning is interpreted as a process that is active, collaborative, situated and distributed (see Fig. 1). The teaching and learning models deriving from this approach are characterized by an active, participatory and experimental didactics (Fig. 1). This kind of didactics enhances the practical and operational dimension of learning (Calvani, 2001). In particular, the approach interprets the appropriation of knowledge as "a knowledge in practice" and the context of training as a "community of practice" (Lave and Wenger, 2006).

According to the situated learning model, knowledge is defined starting from practice. Therefore, learning must also be conceived as strictly bound to human social practices. These practices give rise to meaning construction. In particular, meaning emerges from a negotiation process that combines *participation* and *reification* (Wenger, 2006). This implies that in the planning of a teaching and learning situation it is important to balance forms of participation (first through *legitimate peripheral participation* and then through *full participation*) and the reification of knowledge to be taught (learning materials, instruments, devices, texts, programs and so on). If reification allows the participation in the practice, the learning process is facilitated, on the contrary it will be limited.

Fig. 1. Summary of the elements related to the concepts of knowledge in practice and collective knowledge, which contribute to the definition of the metadisciplinary didactic model.



We use an intrinsically social approach. This means interpreting knowledge as the product of a collective mind that is organized according to a principle of specialization of cognitive work but also interdependence (Sloman and Fernbach, 2018).

2.3. Curriculum architecture

In order to build a metadisciplinary didactic model, we must use a specific curricular design. The curriculum is a theoretical and practical device that allows knowledge, practices and competences to be articulated coherently (Martini, 2009). The articulation of these three elements confers unity and completeness to the design of the curriculum, as these elements are linked by a logical relationship. The selection and organization of knowledge must be consistent with the skills that we intend to promote, and these skills must be developed within situations that allow students them to put them into practice.

From a theoretical point of view, the curriculum structure can be articulated on two levels, each one aimed at developing the following two types of learning: the learning of knowledge and skills (first-level curriculum objective) and the learning of *habitus*, that is, of long-term mental habits (second-level curriculum objective) (Baldacci, 2006). As already said, these two kinds of learning take place simultaneously. As a consequence, the teaching situations for first-level and second-level objectives must be organized in parallel. This means constructing educational situations in which different logic levels are involved at the same time: declarative and procedural knowledge, but also competences.

From a practical point of view, curriculum design can be of two types: (a) the first type defines learning objectives in advance, then selects the teaching content and identifies teaching practices for the development of the expected skills; (b) the second type, on the contrary, identifies learning objectives a posteriori, deriving them from the teaching-learning situations (Bonaiuti, Calvani, Ranieri, 2007). In both cases the curriculum is focused on the relationship between learning objectives and teaching practices. The curriculum with predefined objectives derives practices from objectives and traditionally has a structure that is linear and based on transmission. The curriculum with open objectives derives objectives from practices and has a structure that is non-linear and based on problems.

In our communication design approach, we adopted a curriculum with open objectives (type b), using the theory of didactic transposition (Chevallard, 1991). We gradually improved the curriculum in an iterative manner on the basis of actual classroom experiences.

In didactic transposition, knowledge is removed from the original site of production, adapted and introduced into a teaching situation (Schubauer Leoni, 2008). Transposing, therefore, means putting scientific expert knowledge into a didactic form so that it can be taught and learned. With the term "expert knowledge", however, we must understand not only the formal knowledge emerging from the scientific community, but also the non-formal knowledge emerging from professional social practices (Martinand, 2001).

According to Develay (1995) the taught knowledge depends on the interaction between scientific knowledge and professional social practices through the processes of axiologization and teaching mediation. Axiologization consists of the selection of specific knowledge on the basis of its relevance with respect not only to the discipline but also to the construction of professional *habitus*. Teaching mediation consists of identifying specific teaching practices that mobilize knowledge and skills that are functional to the development of the expected competences.

This extension of the epistemological pole from formal knowledge to professional social practices is particularly appropriate in the case of communication design because this is a "weak-status" knowledge that emerges from a pre-existing professional field through a (predominantly) secondary disciplinarization (Hofstetter and Schneuwly, 2014). In the context of didactic transposition, interpreting professional social practices as an expert form of knowledge has a precise epistemological meaning. First, it means questioning the idea of the absolute superiority of academic knowledge, which is instead considered to be one practice among others (the practice of research) (Astolfi et al., 2008). Second, it means underlining the dynamic and dialectical relationship between the theoretical level of formalization and the empirical level of praxis.

2.4. An example of multidisciplinary curriculum design

An example of multidisciplinary didactics that made use of the concepts described in the previous sections concerns the joint teaching activities carried out in 2015-2016 at as part of the Bachelor's in Graphic Design and Visual Communication (ISIA Urbino) and the Science of Primary Education (University of Urbino; see Martini and Perondi, 2016). The following academic teaching disciplines were identified within the respective curricula:

- Typographic techniques
- Design methodologies
- Iconography
- Pedagogy of knowledge
- Docimology

The involved professors identified common educational objectives:

- Organizing work (processes, objectives, timing)
- Systematically analyzing a problem
- Coordinating micro and macro objectives
- Prototyping and testing
- Cooperating

The students were divided into mixed working groups composed of communication design students and undergraduate primary school education students. The groups were asked to collaborate on a project, for which they had to deal with the aspects relevant to their respective courses of study. The project consisted of the following parts:

- The brief
- Work plan
- Objectives
- Knowledge customization
- Potential competitors
- Innovation
- Justification of choices about content, mood, ICT, etc.
- Testing

The assignment included two design tasks:

1) design publishing artifacts (cross-media narrative system and cross-media exhibition system) that facilitate teaching and learning;
2) design a testing tool for the developed artifacts.

We used shared assessment criteria to evaluate the projects. The results of this experience were shown and discussed in Martini and Perondi (2016).

Figures 2 and 3 show some artifacts developed by students at ISIA Urbino for the joint course in editorial design during the academic years ranging from 2013 to 2016.

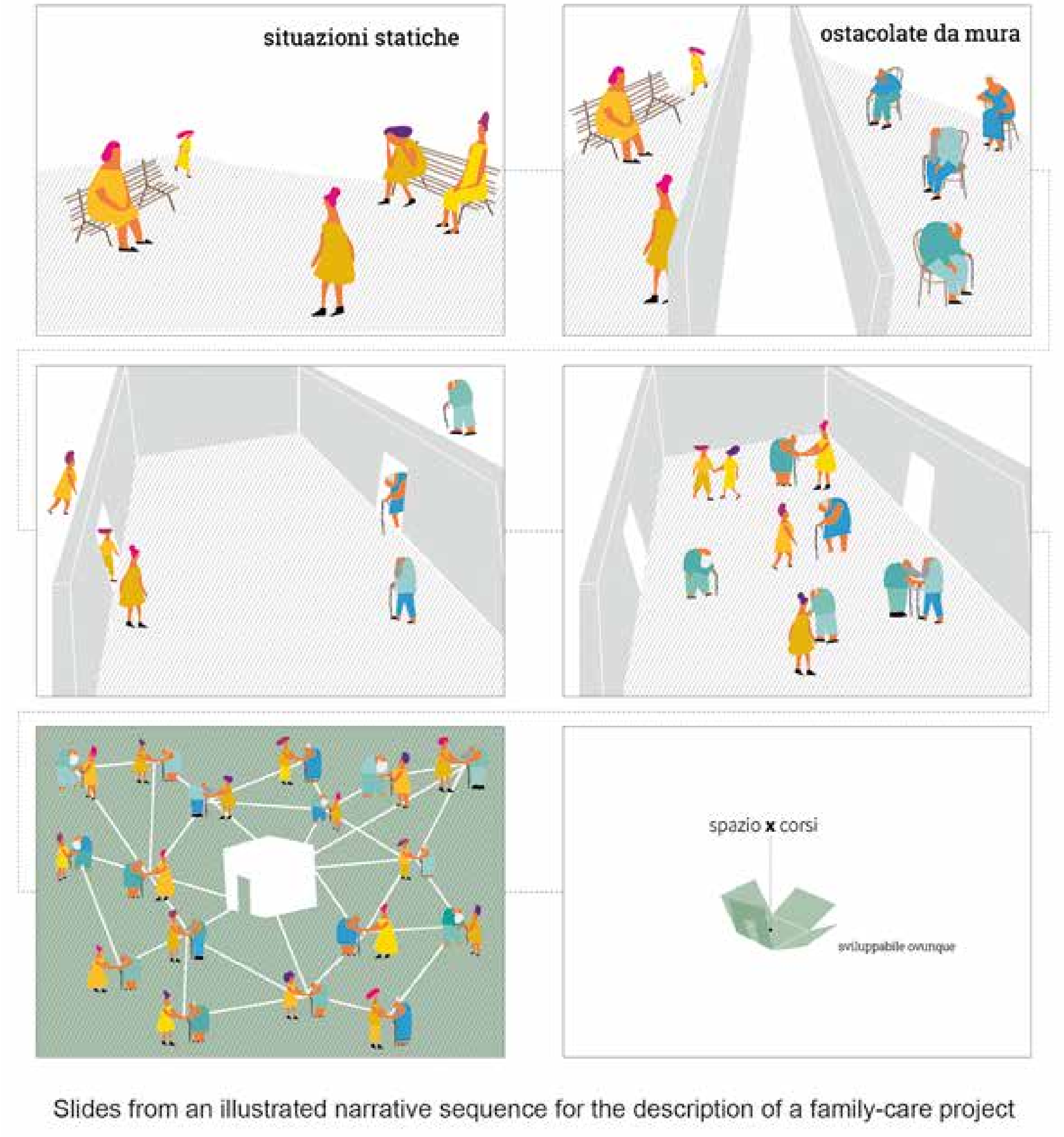


Figure 2. Spazio Meta is a proposal for the management of care relationships between elderly people, carers and families, which can be applied in different urban communities. The project consists of a place in which people seeking carers can meet the people who offer care. The aim of the project is to provide recognition and real value to the work of carers in the eyes of the community. The proposal consists of design of activities, alternative methods for selecting carers, and informal training. The project also provides guidelines for the creation, management and development of a meeting place that can become a node in a new social network in the city. This would be done through interventions such as legal counseling, social assistance and the design of spaces and communication. The project was carried out as a joint effort between ISIA di Urbino and Università degli studi di Urbino, academic year 2013-14, with students from courses in editorial design, law and sociology, and with the contribution of A. Maurizi, E. Bitto, F. Zaupa, M. Lonardi, V. Monacelli, teachers B. Chia, L. Romei, L. Perondi, Y. Kazepov, P. Polidori, L. Angelini.

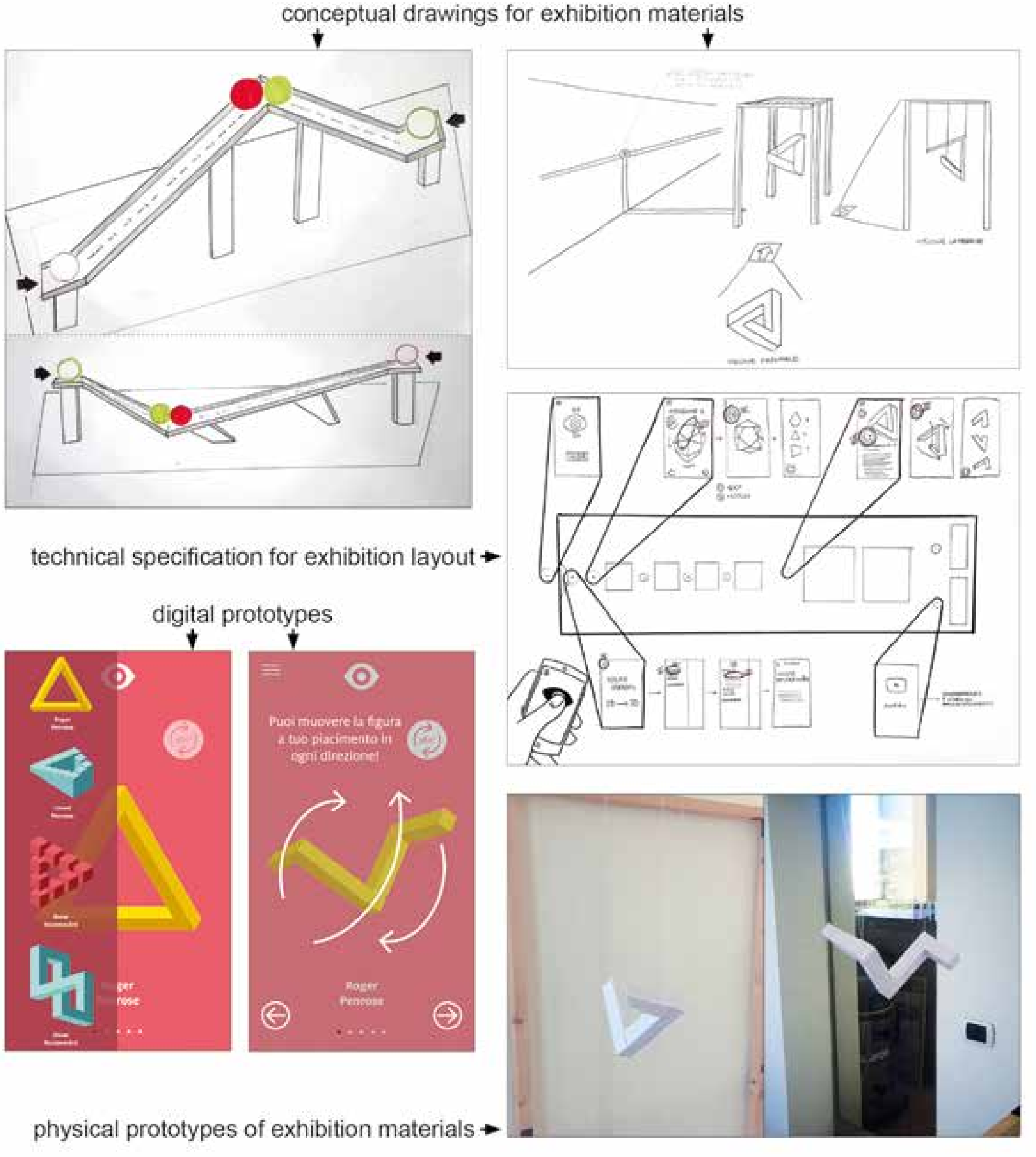
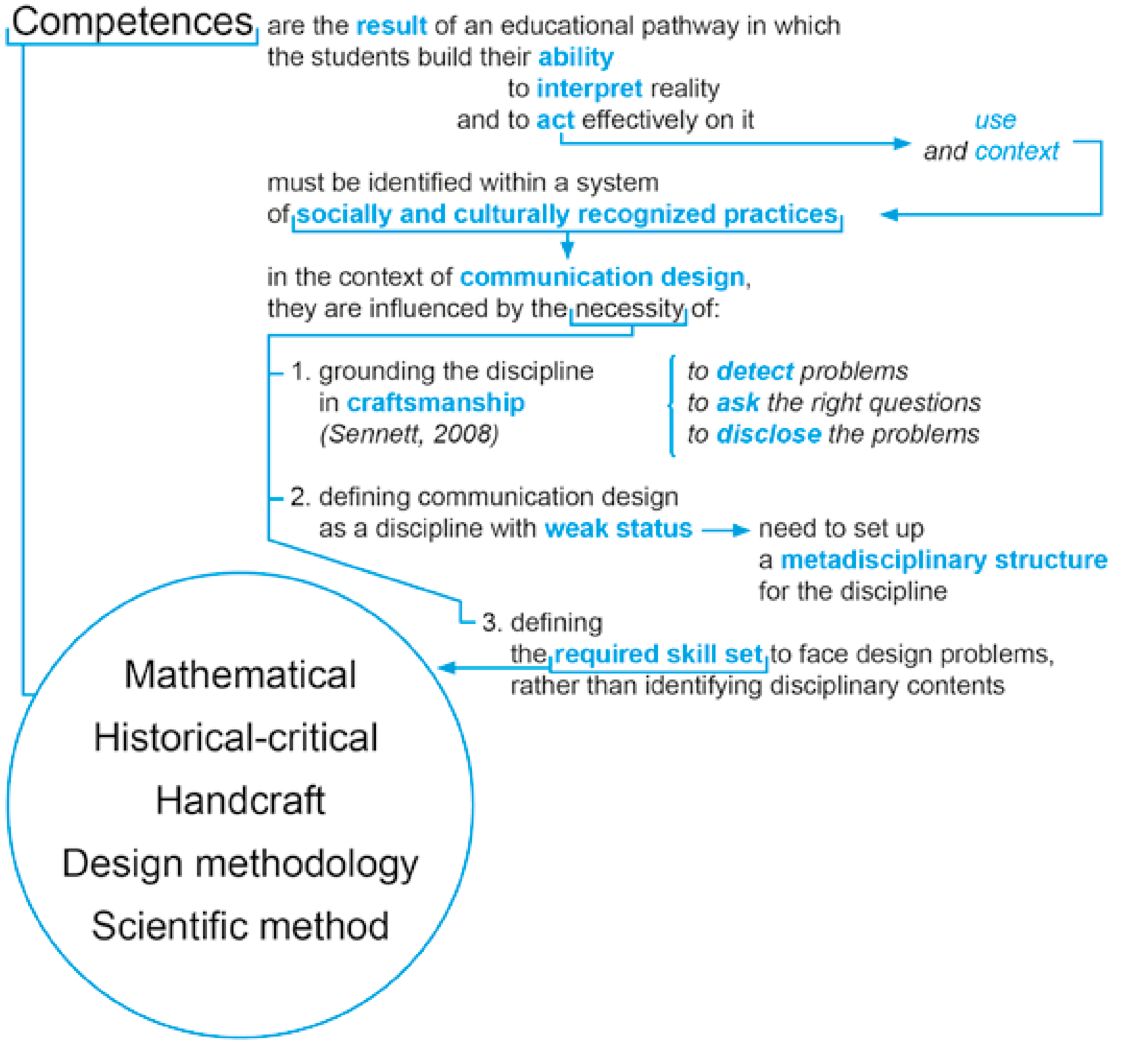


Fig. 3. I'M POSSIBLE is an exhibit for children on the theme of impossible figures, in which the integration of communicative artifacts (videos and exhibition boards) and interactive activities (games and individual and group exercises) involve the children in critical analysis of the complex concept of impossibility. The children explore and physically experience impossibility— which consists, in this case, on of the lack of isomorphism in these particular drawings—by comparing and observing the (non-)correspondence between images and solid objects. The project was carried out as a joint effort between ISIA di Urbino and Università degli studi di Urbino, academic year 2015-16, with students from courses in editorial design and primary education, and with the contribution of C. Cairo, G. Cruciani, L. Zennaro, C. Schiaratura, P. Landolfo, teachers B. Chia, L. Romei, L. Perondi, Y. Kazepov, P. Polidori, L. Angelini.

3. Competence-oriented teaching vs. discipline-oriented teaching in communication design

Within the socio-constructivist approach, competences are the result of an educational pathway in which the students build their ability to interpret reality and to act effectively upon it. Competences must be defined in relation to their use in different contexts. In other words, they must be identified within a system of socially and culturally recognized practices. Within this framework, we selected the basic competences to be pursued by starting with recognized practices in the field of communication design (Fig. 4).

Fig. 4. Competences and the related features of the didactic design



A competence-based curriculum in communication design faces a tension between two opposing forces: (1) One on hand, communication design must be grounded in craftsmanship (and we consider all the competences listed below to be craftsmanship or artisan competences). Sennett (2008) describes craftsmanship as the ability to detect problems, ask the right questions about them, and disclose them. These competences led the community of communication design professionals to form the basic body of knowledge of this field (although it is not yet organized systematically). (2) On the other hand, communication design has weak epistemological status, and therefore the didactic design must be metadisciplinary.

We also considered the need for flexibility, given that students will develop their careers in a quickly changing context. Given these considerations, instead of identifying disciplinary content, we focused on the skill set that students would need in order to face design problems. We identified a set of basic competences (Fig. 5) derived from communication design courses and expert designers' personal experience and teaching. The competences we focused on are mathematical, historical-critical, handcraft, design methodology and scientific method (see Fig. 5)

3.1. Mathematical competence

The communication designer uses mathematics for description. Through mathematics, a designer can describe the project accurately and in algorithmic form, with the aim not only of specifying the project's structure, but also allowing its mechanical and/or digital reproduction. For a communication designer, handling mathematical tools means mastering the language of science. These tools allow the communication designer to access shared knowledge that has been developed by other scientists, and which can technically support the work and the choices of the communication designer (Marini, 2011). Donald Knuth, with Metafont, has shown how mathematics can serve as a tool for understanding and defining the basic structure of a graphic problem (the shape of the letters and the relationships between letters), providing a rigorous description that is understood by a human being and easily computable by a machine (or a description which can be used as a specification for a software implementation, at least) (Knuth, 1979).

The ability to describe a problem—which is strongly related to competences in design methodology (section 3.4.) and in scientific method (section 3.5.)—makes it possible to store knowledge until it is ready to be reused (see above discussion of Marini, 2011). Communication designers might not need to become mathematicians, but they need to master the language and tools of mathematics as a support to their work and as a means of communicating with computers and with other professionals.

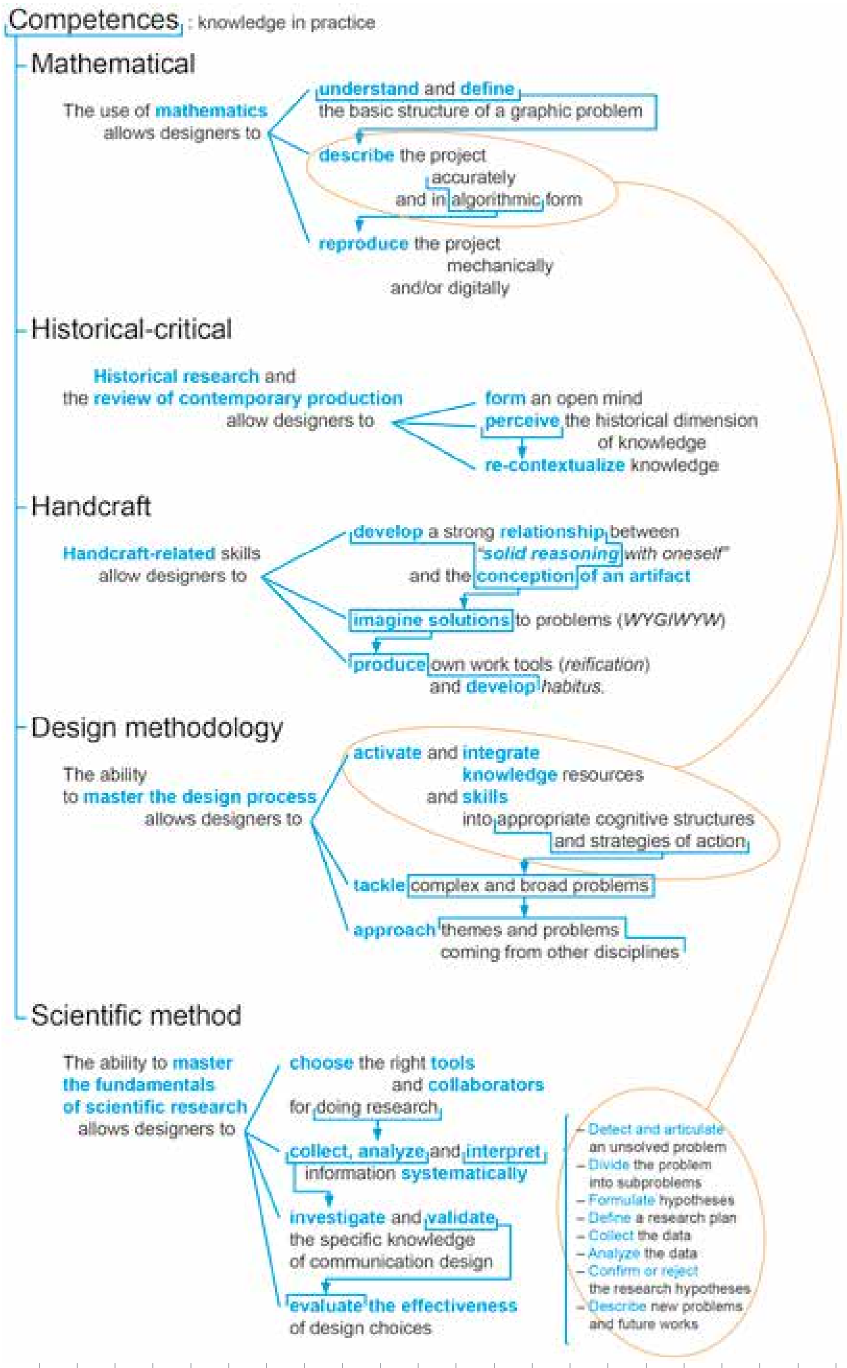


Fig. 5. Competences for a metadisciplinary curriculum in communication design

3.2. Historical-critical competence

Fundamental competences in the education of a communication designer are historical research and the review of contemporary production. Among the various currents of historical research, of particular interest for the education of communication designers is the innovative approach adopted in France during the '20s by the historians of the Nouvelle Histoire, which revolved around the École des Annales (Burke, 1992). In particular, the metadisciplinary nature of this current is of interest: historiography is complemented with other disciplines (from which the historians take tools and methodologies), and these disciplines become partners in the search for documentation.

This competence includes:

1) Searching for documentation: the activity of searching for documentation has to be designed and has to encompass both physical and digital archives. For example, knowing the logic behind a search engine allows students to infer how to set up a search query that can lead to a targeted, deep search. Requires understanding the principles of mathematics/information technology underlying the storage of information in a database.
2) Selecting sources: understanding of hierarchy and classification of sources is key to structuring a corpus of documents. The main challenge is interpreting the hierarchy of sources (primary, secondary, etc.) based on the research objective.
3) Understanding deeply the cultural and historical background of the project as a foundation for innovation.

Generalizing some considerations by Dario Antiseri regarding the teaching of the empirical-experimental natural sciences (Antiseri, 2000), we underline the contribution of historical analysis in forming minds that are anti-dogmatic and open to multiple perspectives. Such minds are aware of the influence that the socio-cultural context exercises on the scientific progress of every specific form of knowledge as well as of the obstacles, both theoretical and practical, that have marked its evolution. According to Antiseri, confrontation with history is a basic ingredient of an authentic "epistemological didactics" that emphasizes posing questions rather than lists of possible solutions, treating error as a source of knowledge and progress, and—we add—viewing innovative thinking as linked to the ability to pose new interesting questions, or to think outside the dominant conceptual schemes that shape every historical-cultural period.

It is not by chance that one criterion of the didactic transposition criteria is that of "historicization." Letting students perceive the historical dimension of knowledge contributes to the process of re-contextualizing knowledge within the didactic system (teacher-student-knowledge). The didactic system is not the transparent effect of our will. Its functioning requires that expert knowledge, in order to be taught, must undergo certain transformations that make it suitable for being taught and learned.

When knowledge is selected as knowledge to be taught and enters an educational pathway, it undergoes transformations that generate another type of knowledge. Among these transformations we point out *decontextualization* and *depersonalization*. These transformations indicate the process of "separation" of knowledge from the historical-social context in which it was produced, from how and why it was established. Historicization is then configured as a process of re-contextualization and re-personalization of knowledge within the didactic system (Martini, 2011).

3.3. Handcraft competence

The term "handcraft" refers to producing artifacts and tools with one's own hands. The handcraft competence is closely intertwined with the knowledge acquisition. In a research area such as communication design, which descends from practices stretching back centuries, the competence of handcrafting artifacts, as well as everyday training and practice, are strongly tied to the ability to conceive of these artifacts and to imagine possible solutions to problems. Moxon (1683, p.6), in the preface of his *Mechanick Exercises*, states: "(…) by a typographer, I mean such a one, who by his own Judgement, from solid reasoning with himself, can either perform, or direct others to perform from the beginning to the end, all the Handy-works and Physical Operations relating to Typographie".

The handcraft competence requires students to develop a strong relationship between "solid reasoning with oneself" and the conception of an artifact through full knowledge of the opportunities offered by the available tools. This competence allows the designer to approach a problem with the logic of "what you get is what you want" (WYGIWYW) as opposed to the easier logic of "what you see is what you get" (WYSIWYG) typical of contemporary interfaces. This perspective impacts on handcraft practice, as well as IT programming, which is seen as a mode of production of the designer's tools. In addition to the skills of drawing, photography, printing techniques and the production of images in general, the handcraft competence also includes skills related to expressive composition and configuration. These latter skills are not formalized but rather are acquired through everyday practice and through comparison with historical and contemporary examples. The handcraft competence includes also the more systematic components of communication design, such as the manipulation of visual variables, typesetting, quantitative data visualization or scientific and technical representations. The handcraft practice allows students to develop tools and modes of creation that are impossible to develop through speculation and theoretical thinking. Moreover, the craftsman approach is often scalable to industry: by carrying out the entire process of production as a craftsman would, the student can understand the logic behind mechanical, automatic, and parametric industrial production.

A significant example of the handcraft competence is the case of Galileo and the surface of the moon. Samuel Edgerton (Bredekamp, 2011) describes how Galileo's painting skills allowed him to reproduce the roughness of the surface of the moon by observing and replicating the line of separation between light and shadow. Other contemporary scholars were not able to do this, even though they had the opportunity to observe the moon through a telescope.

In our metadisciplinary teaching model, the intertwining of handcraft competence and formal knowledge is consistent with a socio-constructivist approach to learning (see paragraph 2). This is focused, in fact, on the idea of distributed knowledge—the idea that knowledge is not only in the mind of the learners but also in the objects, in the environment and in other people. From this point of view, constructed artifacts are a reification of individual and social knowledge. Therefore, learning environments (Wilson, 1996) must allow learners to act *on* and *with* objects in a collaborative way. Acting *on* and *with* objects progressively structures the craftsman's habitus (Sennet, 2008), which is a *modus operandi* that aims to allow the learner to improve his or her background knowledge.

3.4. Design methodology competence

We return to our discussion of Morin (1999, see section 1) on the ability to tackle broad, complex problems. In considering this competence, we are interested not in the outcome (the performance), but rather in the process (the way of achieving the outcome). In this sense, the competence in design methodology indicates to what degree of complexity/broadness the individuals are capable of dealing with a problem. In this regard, Le Boterf (1997) proposes to move from an "atomic" concept of skills to the concept of "architecture" of skills. This move allows us to distinguish between different styles of organization and integration of resources and knowledge in different cognitive structures and strategies of actions. The design methodology competence plays a fundamental role in communication design (and of design in general). It is the ability to activate and integrate one's resources and skills into appropriate structures. This competence is probably the one that most distinguishes the field of communication design (and of design in general).

We especially focus on the ability to deal with problems of various types (asking the right questions), develop solutions based on the combination of previous experiences, and draw on knowledge coming from other disciplines. From an educational point of view, the various kinds the problems determine the type and level of competence required. So it is necessary to identify types of problems to identify types of competences.

In design schools, the competence in design methodology is usually "transmitted" from professionals to students through simulations that approximate real-life projects to varying degrees. The teacher guides and corrects the students in their attempts, during a series of individual or group meetings and revisions. The underlying educational model is that of cognitive apprenticeship (Gardner, 1991). The teaching practices for this model are simulation, problem-based learning (Barrows, Tamblyn, 1980), project-based learning (Borghi, 1969), scaffolding and tutoring (Wood, Bruner, Ross, 1976), modeling (Bandura, 1967). The student acquires this competence through a process of trial and error process. It is difficult in this field to establish a "quality control" that is coherent and systematic. However, this competence is a very specific characteristic of the designer. It also makes it easier for design students to approach themes and problems that go beyond basic design education, right from the first stages of the program of study.

3.5. Scientific method competence

Communication design students must acquire skills in the the scientific method, which are closely related to mathematics and historical research. On one hand, these skills allow communication designers to conduct a quantitative evaluation of their choices. On the other hand, they permit communication designers to deepen and validate the specific knowledge related to the domain of communication design (such as visual variables and typographic composition).

Students must master the fundamentals of research, understood as a systematic process of collecting, analyzing, and interpreting information (Leedy & Ormrod, 2010, p.2). The research consists of phases, which directly inform the subsequent ones in an inferential process. While the experimental design varies according to the type of research, the scientific method generally follows a set of established steps (Leedy & Ormrod, 2010, pp. 2-7, see Fig. 5). It is no coincidence that these steps are similar to those for developing a mathematical/software algorithm, since both processes are based on a chain of logical inferences.

Another fundamental aspect of this competence is to know at least some basics of experimental design. The variety of experimental designs is very wide (e.g. with or without control group, one-shot, longitudinal, mixed-group, etc.) and a designer doesn't need to know them all. However, having knowledge of basic experimental designs helps designers choose the tools that best suit the kind of research they need to carry out and, more importantly, the collaborators from other disciplines that they need to collaborate with.

If experimental data will be quantitative, communication designers need to understand the mathematics underlying the statistical methods used to analyze these data. In fact, this knowledge is key for devising an appropriate experimental design. Once the researchers have detected the right kind of mathematical analysis to perform on the desired research data, they can choose from a range of experimental designs that are suitable for collecting the right kind of data. The ability to choose, set up and conduct an experimental design is at the heart of the scientific method competence.

4. Horizontal sharing of knowledge among students

Students have a variety of mental models, because students integrate learning in the school environment with their own attitudes, hobbies and past experiences. This diversity means that a one-size-fits-all teaching model won't work. But it is also an educational resource. In fact, having classes of students from different backgrounds facilitates a metadisciplinary approach, because it forces the teacher to diversify learning situations accordingly. All the students begin their program with strengths or weaknesses in the areas we have listed above. The program of study should ideally enable them to continue to develop their strengths and to overcome or at least explore their weaknesses.

The cognitive input that derives from the carrying out of teaching activities in classroom environment is fundamental but necessarily limited in time and in the amount of information available to the student. Students' horizontal sharing of knowledge (distributed knowledge)—even if only at the level of self-teaching obtained through unsupervised direct interaction with relevant didactic mediator tools (Rézeau, 2002)—should therefore be planned and exploited as a didactic resource. This approach aims not only to compensate for the scarcity of top-down knowledge that teachers or experts can transmit to students, but also to teach the students how to share their own cultural backgrounds with each other.

The sharing of one's cultural background implies not only the application of previously acquired skills, but also a synthesis and an explanation so that the other members of the working group can understand them and integrate them operatively in their everyday work. This capacity for sharing is in fact a metadisciplinary competence of communication design, which is learned during practice, through continuous mediation with other students (see section 2.2).

5. Expected results

A metadisciplinary competence-based didactics has been partially applied in teaching and curriculum design for bachelor's level programs at the ISIA of Urbino since its foundation as the Corso Superiore per Arti Grafiche in 1962, and also in previous experiences, of which the most famous is the Ulm College of Design. We believe that the development of this approach can increase students' innovative and cognitive potential, increase the explicit contribution of communication designers to human progress and knowledge sharing, and open new professional areas by increasing contacts with new disciplinary domains.

The reflections described in this article form the basis for a system of ongoing evaluation of the didactic outcome. This curriculum has never been applied fully, but it can be an important comparison tool for evaluating the effects of curriculum choices in relation to the model we propose. For example, the mathematical competence and the scientific method competence are generally considered marginal in a design curriculum. Moreover, students of different disciplines are generally only mixed at higher levels of training (master or doctorate). This practice puts students in a sort of "bubble" that prevents them from integrating with other professionals and into professional life. Obviously this occurs more significantly in disciplines with a strongly vertical curriculum.

An important next step would be to conduct a longitudinal research project on the students' educational trajectories and their career paths after earning the bachelor's, with respect to the full range of variables introduced in the curriculum by this model (not only the competences outline here, but also teaching methods, learning styles, the relationships among competences, teacher profiles, funding, etc.). Gathering information about the profession or the disciplinary domain in which the former students work after obtaining the degree can provide data on the relevance of the metadisciplinary approach proposed in this article. Another important step would be to detail, for each specific case of curriculum development, the educational objectives to be achieved in regard to each of the five competences we have outlined.

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Giampiero Dalai
Alpaca Società Cooperativa
via Giuseppe Garibaldi, 5, 44121 Ferrara FE (Italy)
giampiero.dalai@alpacaprojects.com
Interaction designer with a background in visual communication design. He has been a speaker at several international conferences since 2017, publishing articles in the field of information design and the development of interactive communication artifacts. He focuses on design for education and design for all. He co-founded Alpaca cooperative in 2016.

Berta Martini
Dipartimento di studi umanistici, Università degli studi di Urbino Carlo Bo,
Via Bramante, 17, 61029 Urbino PU (Italy),
berta.martini@uniurb.it
Full Professor at the University of Urbino where she coordinates the degree course in Primary Education Sciences. She is co-director of the online scientific journal *Pedagogia PIU' didattica. Teorie e pratiche educative*, and she is a member of the scientific boards of peer review journals and publishing series. Her main fields of interest and research are the processes of transmission of knowledge in education contexts and in curriculum studies. Among her numerous publications, we report *Didattiche disciplinari* (Pitagora, 2000) and *Pedagogia dei saperi. Problemi, luoghi e pratiche per l'educazione* (FrancoAngeli, 2011).

Luciano Perondi
Dipartimento Pianificazione e Progettazione in Ambienti Complessi,
Università IUAV di Venezia, Santa Croce 191 Tolentini, 30135 Venezia VE (Italy)
lperondi@iuav.it; Tel.:+39-388-1697785
Has been involved professionally in type and information design since 1998.
His main fields of interest are writing and reading process, the history of writing and its non linear use (sinsemia).
From 2003 to 2007 he run the studio Molotro.
From 2007 to 2018 he has been tenured lecturer of "History of book" at Isia Urbino.
From 2013 to 2016 he has been the Director of the same Institute.
Since 2018 he is Associate Professor at IUAV Venice.
He is partner of the cooperatives CAST and Alpaca.

Monica Tombolato
Dipartimento di studi umanistici, Università degli studi di Urbino Carlo Bo,
Via Bramante, 17, 61029 Urbino PU (Italy),
monica.tombolato@uniurb.it
Received a PhD in Epistemology and one in Education from University of Urbino. She taught in secondary school. She is currently a postdoctoral fellow and a contract professor for the Pedagogy of Knowledge Lab and Physics Education Lab at the Department of Humanistic Studies, University of Urbino. She is the author of essays and articles concerning the philosophy and pedagogy of knowledge.