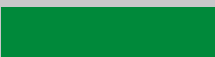
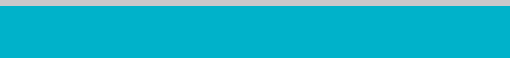
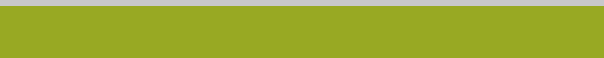
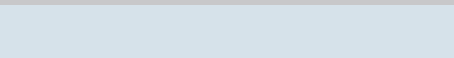
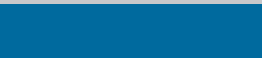
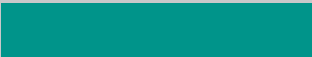
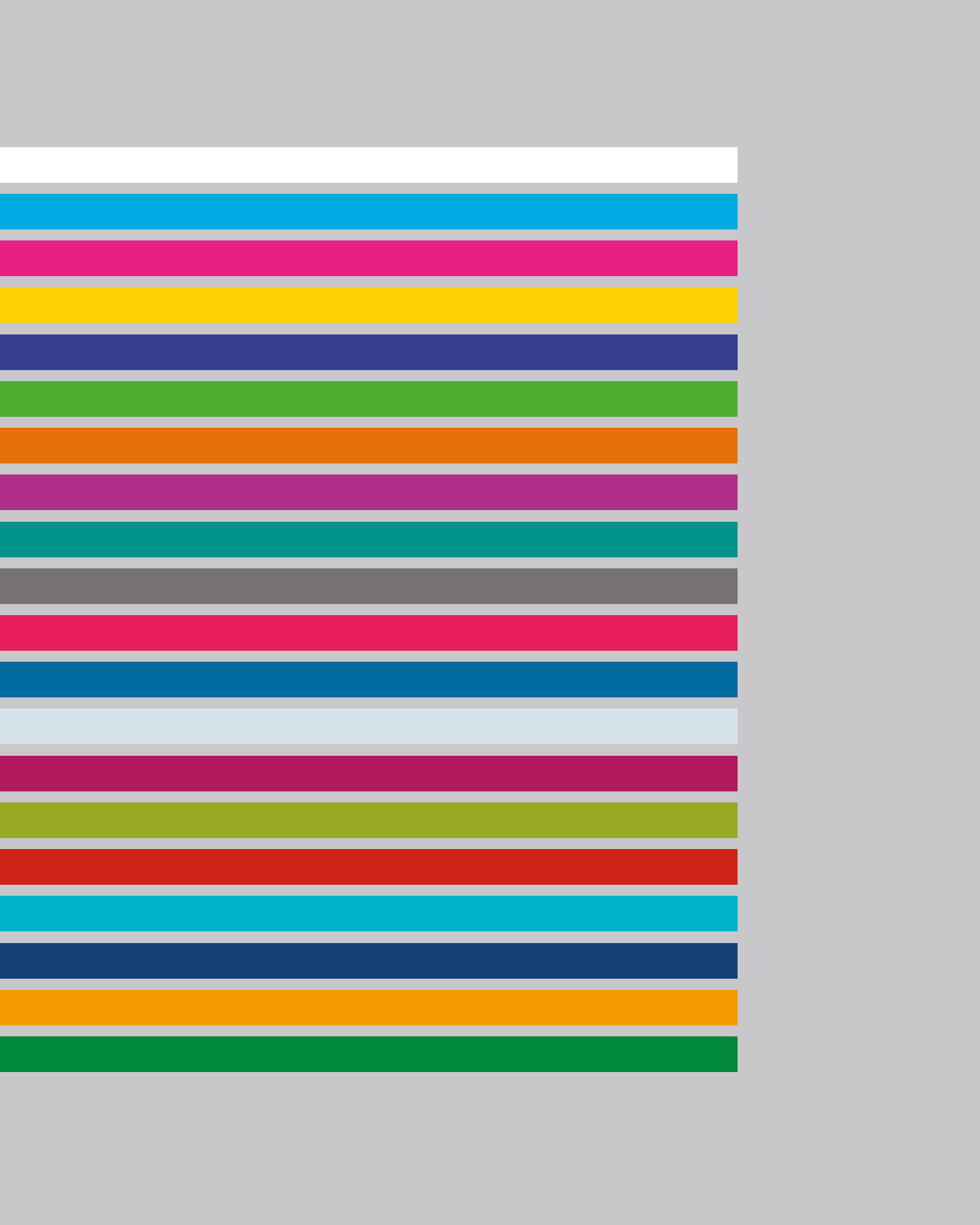


SEMINARIO

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## SEMINARIO

## INVESTIGACIÓN

## DISEÑO II

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## SEMINARIO DE INVESTIGACIÓN EN DISEÑO II

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CAPÍTULO AUTORA INVITADA

## LEARNING AND GLOBAL CHALLENGES: SCENARIOS FOR DESIGN

Learning = learning to learn

Dialogue = seeing oneself through the eyes of another

Truth = the invention of a liar

Manuela Celi

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The consolidation of the knowledge-based society has reawakened attention in several scientific disciplines to education, to the effects that it produces on the various industry sectors and to its implications for the process of economic growth. Nevertheless, there is still a clear gap between the rapidly evolving demand for learning and the capacity of universities to respond, as they are also evolving but along other lines. While lifestyles are transformed rapidly and ever more invisible technologies insinuate themselves into daily activities, the transformation of teaching institutions associated with consolidated knowledge and preservation of knowledge.

Already at the Lisbon European Council in March 2000, together with the ambitious aim of becoming *the most dynamic and competitive knowledge-based economy in the world*, the EU included education permanently at the top of its policy priorities, calling for education and training systems to evolve so that they would be ready to meet this challenge.

The Bologna declaration, signed by 29 countries, was issued with the aim of introducing a system of easily “readable”, comparable academic qualifications, promoting mobility, assuring quality in teaching and taking into account the European dimension in higher education, now has 40 signatory countries. The process will conclude in 2010 and has been updated over time through a series of European conferences (Berlin 2003, Bergen 2005, London 2007). Confirming how the process set in motion in Bologna has changed the attitude of university institutions throughout Europe, the document recently drawn up in London expresses a broad, growing awareness that the most significant result of the process will be the transformation of higher education into a system centred upon *learning* as opposed to *teaching*.

Processes of cultural, political and economic globalisation, the influence of the communication systems and networks that permeate society, and developments in information technology have progressively increased people’s opportunities to access knowledge. In this context, however, it is necessary to make a number of distinctions: while the mere dissemination of information can easily be supported through the use of telematics, the generation and circulation of knowledge requires a specific process of “packaging” in which individual experiences (or information acquired) are encoded and converted into visible objects, and therefore also knowable by others. Thus, it is not information that is the critical factor, but rather the knowledge produced by that information.

Knowledge has less and less to do with the learning of content and is increasingly coming to be identified with the capacity to encode and decode messages<sup>1</sup>. Control over the production, accumulation and circulation of knowledge depends on the capacity to manage the codes.

In this scenario, universities are called upon their role by designing an education system that is no longer based on consolidated knowledge but on fluidity of knowledge. Dealing with continuously evolving content means modifying one’s approach to knowledge, learning to learn, developing metacognitive capacities and acquiring autonomy in decoding and encoding information.

For universities that focus on Design, this is certainly a challenge. However, it is a challenge that is highly suited to a discipline which is characterised by an inductive approach, which deals with theoretical aspects as well as technical problems, which concerns a practice that includes representation and creativity among its tools. In other words, taking up this challenge means “redesigning design teaching” ... on condition that it is not merely a restyling operation.

## RESEARCH AND TEACHING: A JOINT APPROACH

The document signed in Bergen stresses the importance of research, of research training and of fostering interdisciplinarity in order to maintain and improve the quality of teaching in higher education and strengthen its competitiveness. The role of research in teaching design is fundamental. However, it is necessary to distinguish three types of research in the subject area of design: research into (or on) design often conducted starting from other disciplines, research for design such as is carried out in divisions such as research and development (R&D), and research through design<sup>2</sup> in which design practice plays a methodological role of its own. Research on design is probably the most widely practised and the one with the broadest tradition: it consists of all those forms of research of which design is the object analysed variously through historical, sociological or technological interpretative perspectives. Research for design is the type in which the final product is an artefact in which knowledge is incorporated into the artefact with a view to communicating content iconically.<sup>3</sup>

Research through design is the form of research which most closely concerns teaching: in this case design is the vehicle of the research and represents a means for communicating the results. Research through design has been examined by several authors who have variously defined it as practice-led research, action research, or project-grounded research, as Findeli defines it. Although he believes that this form of research is only a variation of research on design with an accent on the theoretical aspects, he highlights the role of creativity in this type of research and asserts its independence from other disciplines:

*"[...] we are left with the conviction that there is indeed a specific 'designerly way of knowing'; that this knowledge and its objects deserve to be investigated and that creativity is a necessity, not only for design practice, but also for design research. Also, we may be confident that, after having depended on so many foreign – sometimes even exotic – academic disciplines, design is about to gain its sovereignty and to contribute to general knowledge, by posing new and relevant research questions and by helping reduce uncertainty and ignorance about what concerns us all: the nature, meaning, and purpose of the relationships of human beings with the world, especially the artificial world."*<sup>4</sup>

In Schön's approach, it is specifically reflection in practice that constitutes a way of doing research and therefore of learning but, at the same time, within this process it is also necessary to evaluate the role of the actors involved.<sup>5</sup> Downton proposes considering designers themselves as the subject of design research: design-related knowledge lies in knowledge possessed, utilised and applied by a single individual.<sup>6</sup> This proposal highlights how learning individuals are the focal point of research, and helps us to distinguish between on the one hand knowledge as the result of an original process – in which actors, objects and relations can be distinguished – and on the other an immanent design knowledge incorporated in the *designer*.

How can this tacit, implicit knowledge in an individual's design activity be transmitted to and learnt by another individual? What might the process for learning through research be?

## TEACHING FOR DESIGN AND TEACHING THROUGH DESIGN: LEARNING THROUGH PROJECTS

The need to codify professional practice is the focal point of the inductive approach and in university teaching translates as a process of "institutionalisation" of design competencies.<sup>7</sup> In this connection, research plays a key role, offering universities a useful instrument both for interpreting cultural, technological and market changes and for offering designers fully-developed educational content with a wealth of methodological tools for them to face and adapt to a continuously evolving context. Nevertheless, the introduction of research into university curricula and the transition from a "creative" approach to one based on reflection in practice constitutes processes that are not without their obstacles.

At a moment of crisis of local production systems and the underlying system of relations, the Design Faculty occupies a position between the world of entrepreneurial design, consisting of knowledge that is not codified but shared by professional communities, and codified, institutional knowledge.

It was in Milan in the 1990s that the first Laurea Pro-

gramme in design was created at the Politecnico, a cutting-edge educational institution, a meeting point for different cultures to combine their architectural and artistic knowledge, characterised by creativity, together with the technical and scientific research of engineering. Although Industrial Design had entered the universities and science and technology institutes over fifty years previously, firstly in the European industrialised countries, North America and Japan and then in the emerging, more recently developed countries, in Italy (where nevertheless many private institutions had introduced – some of them authoritatively – this major strand of study into their syllabuses), the discipline of Design had remained detached from the university context. Precisely because it was the first in Italy and lacking in contiguous models of reference, the experience of designing the Laurea Programme in Industrial Design, which became the Design Faculty in 2000, constituted a representative case for examining the forms of pedagogical innovation ushered in by the reform of Italy's university system, of which the Programme was a precursor.<sup>8</sup>

The theoretical currents that have developed in the areas of cognitivism, learning psychology and sociology of knowledge lead to the creation of a new vision of the process of *construction* of knowledge: a model of design learning is born, founded on the theoretical problematisation of design itself.

Schön proposes an epistemology of professional practice by means of a thoroughgoing analysis of the behaviour of certain professionals operating in the "design professions"<sup>9</sup>. He explores ways of seeing in design, the roles of prototypes and structures and the potential of technology tools in order to understand how forms of knowledge which stem solely from professional practice, and which professionals themselves cannot explain, can be generated and codified. Within this detailed analysis, ample space is dedicated to a reflection on educational themes:

*"These studies seem to me to indicate three main directions. Firstly, there is the question of design education, especially in architecture and engineering. One of the most interesting and difficult themes in this case is the development of a productive marriage of artistic ability and applied science in the design laboratory. Secondly, there is exciting potential in the use of concrete tasks, programmes and design games in primary and secondary education. Finally, there is the rather fertile idea of considering teaching and learning through the lens of designing [...]"<sup>10</sup>*

"Reflective practice" can therefore be the lens through which to observe the fame of Italian design produced through certain leading practitioners who have laid claim – albeit implicitly – to the role of design researchers.<sup>11</sup> Milan, with its long tradition born out of the material culture of Lombard craftsmanship and industry, has played a key role not only in the practice and profession of design but also in its teaching. Since its very foundation, the programme has given rise to a teaching approach that differs somewhat from the traditional models by offering a study programme that hinges on an "inductive" approach to teaching for design.

The *design laboratories*, a spin-off from the traditional design programmes offered by the Faculty of Architecture, focus on implementing projects under the guidance of a teaching team consisting of faculty teaching staff, external professionals and *businesspeople*. The team's various skills and professional expertise fulfil the various problematic spheres involved in the design process in order to offer students a complete overview of the possible approaches.

The laboratories, therefore, occupy an intermediate area between *knowledge* and *know-how*. Indeed, the disciplines that characterise the laboratory are in part applied and in part theoretical. This teaching approach requires students to carry out design activities under the guidance of the teaching team, each member of which offers his or her own subject knowledge applied to the design topic in question. Students work in the laboratory both in order to acquire design tools, such as in the drawing and computer graphics laboratories, and to learn design practice, such as in the industrial design and product development laboratories.

The decision to include members from the professional and industrial worlds in the teaching teams is one of the most innovative choices. On the one hand, it reflects the desire to maintain an extremely close link between design teaching and practice as conducted in the professional sphere by bringing into the university skills and expertise from the world of work. On the other hand, introducing professional expertise links back to the theory of learning as *reflection in practice* by simulating in laboratory activities the very process of design research that generates innovation in the professional and business worlds.

## ELEMENTS FOR NEW TEACHING SCENARIOS

There is no question that Milan views design and the teaching thereof from a privileged perspective. Nevertheless, as has been stressed from the very outset, current approaches to the acquisition of knowledge and the need to learn to learn require dialogue with a certain institutions that are pointing the way to new development scenarios for design teaching. A prime example is represented by Stanford.

### ME310

#### *Stanford University*

Stanford University has a joint approach to teaching design. The Product Design programme is held by the Department of Art & Art History and by the Department of Mechanical Engineering. While the undergraduate programme is named Product Design, the name of the MA programme – Joint Program – reveals its interdisciplinary origins.

Of particular interest from the methodological perspective is a project which was launched in 2005 and is still ongoing. Originally named Loft 310<sup>12</sup>, it has now become ME 310.<sup>13</sup>

The programme, for engineering graduates, is decidedly innovative in terms of the type of approach. Thirty-five students take part in *real* projects sponsored by the companies themselves, yet with a view to producing excellent results a number of specific strategies have been adopted:

1. A context in which the project-based approach is developed: a space that resembles more closely a design studio than a classroom, featuring individual, personalisable spaces, CAD/CAM workstations, Arduino devices and access to the materials and tools required to develop prototypes, all at the same time and in a single place.

2. The team composition method: competencies, a variety of viewpoints, a neutral team leader, a member defined as a “wild card”, maximum diversity in terms of

gender, ethnic origin, years of experience and distance from the campus;

3. Multiple (six) levels of interaction:

3.1. Within the group (peer relations).

3.2. Between the team and the teachers (two full professors actively follow the whole design process).

3.3. Between the team and the coach (a designer/professional with the role of consultant).

3.4. Between the team and the company (a relation which remains exclusively at the professional level and does not interfere with the other levels of interaction).

3.5. Inter-team interaction (in the review activities there is dialogue with the other groups).

3.6. Community interaction (on a weekly basis collective meetings are held which the whole target community attends).

This *modus operandi* produces from seven to ten innovative design projects yearly with an average of two patents a year.

The factor that distinguishes the project is certainly the one which in recent years has given its name to it: “dark horse”. The “dark horse” design mission takes its name from a colloquial expression referring to a little-known competitor, an outsider with little chance of success. If such a competitor’s performance is unexpectedly strong, the payoff is significant. The spirit of the initiative consists in trying something “out there” or apparently “impossible”, forcing the team to take a “fresh look”.

In a setting that allows all of those elements which in traditional teaching struggle to strike up a dialogue with each other to come together, students experience all design on all of its levels: research, brainstorming, concept generation, product development, representation, modelling and communication. Loft 310 combines knowledge, know-how and know-how-to-be into a single, project-based approach.

## SOME CONCLUSIONS

Although very different from each other, the countless examples of innovative teaching approaches are concerned by the process of internationalisation that increasing permeates the education system:

- internationalisation of the workgroup (teachers, tutors, professionals);
- maximisation of the multi-ethnicity of workgroups in order to encourage different design approaches;
- international experiences included in the learning process with a view to expanding students' reference framework and contextualising their own reality in relation to others;
- a historical and process-based analysis of international best practices with the aim of identifying routines that can be replicated in other contexts.

There is, however, another element which cannot be disregarded, which is the fact that learning in the world of design is project-based. It is only through experimentation and the direct experience of carrying out projects and analysing how actual projects have been conducted that design knowledge can be acquired, transformed and codified.



## Bibliography

Bertola P., "Il metaprogetto nella didattica del design", in Deserti, A. (ed.), *Metaprogetto, riflessioni teoriche ed esperienze didattiche*, PoliDesign, Milan (2003).

Bushnell, T., Steber, S., Matta, A., Cutkosky, M., & Leifer, L., "Using a 'Dark Horse' Prototype to Manage Innovative Teams", 3rd International Conference on Integration of Design, Engineering and Management for Innovation (September 2013).

Celi, M. (ed.), *Advanced Design Cultures, Long-Term Perspective and Continuous Innovation*, Springer, Cham, Switzerland (2015).

Celi M., Formia, E., "Humanities Design Lab: Understanding and Shaping Cross-Fertilization Experiences", *Journal of Critical Cultural Studies*. Champaign: Common Ground Publishing (2014).

Downton, P., "Knowing research: researching, knowledge and designing", in *Design plus Research: Proceedings of the Politecnico di Milano Conference, May 18-20, 2000*, Milan (2000).

Findeli, A., "Some tentative epistemological and methodological guidelines for design research", in *Design plus Research: Proceedings of the Politecnico di Milano Conference, May 18-20, 2000*, Milan (2000).

Frayling, C., *Research into Art and Design*, Royal College research paper Vol. 1, no. 1 (1993/4).

Levy, P., *Collective Intelligence: Mankind's Emerging World in Cyberspace*, Basic Books, New York (1999).

Maldonado, T., *Disegno Industriale: Un riesame*, Feltrinelli, Milan (1972).

Melucci, A., "Cosa è 'nuovo' nei 'nuovi movimenti sociali'?", *Sociologia*, 2-3, Istituto Luigi Sturzo, Milan (1992), pp. 271-300.

Newbury, D., "Knowledge and Research in Art and Design", *Design Studies*, 17, Elsevier Science (1996), pp. 215-19.

Oxman, R., "Educating the designerly thinker", *Design Studies*, 20, Elsevier Science (1999), pp. 105-122.

Penati, A. Seassaro, A., Bertola, P., "All'insegna dell'innovazione didattica. Il Corso di Laurea in Disegno Industriale del Politecnico di Milano", in Penati, A. (ed.), *Didattica & Design*, Polidesign Milano, 2000.

Schön, D.A., *The Reflective Practitioner*, Basic Books, New York (1983).

Skogstad, Philipp L., Currano, Rebecca M., Leifer, Larry J., "An Experiment in Design Pedagogy Transfer Across Cultures and Disciplines", *International Journal of Engineering Education*, Vol. 24, no. 2 (March 2008), pp. 367-376 (10).

## NOTES

1 See Melucci "Cosa è 'nuovo' nei 'nuovi movimenti sociali'?" in *Sociologia*, 1992, n. 2-3, Istituto Luigi Sturzo, Milan, pp. 271-300

2 This still-controversial term was coined by Frayling. See Frayling, C., *Research in Art and Design*, Royal College of Art Research Papers Vol. 1, no. 1 (1993/4).]

3 The aim is not to communicate knowledge in a verbal sense but to convey a visual, iconic, imaginative sensation. See Newbury, D., "Knowledge and Research in Art and Design", *Design Studies*, 17, Elsevier Science (1996), pp. 215-19.

4 Findeli, A., "Some tentative epistemological and methodological guidelines for design research", in *Design plus Research: Proceedings of the Politecnico di Milano Conference, May 18-20, 2000*, Milan (2000).

5 Schön, D.A., *The Reflective Practitioner*, Basic Books, New York, (1983).

6 Downton, P., "Knowing research: researching, knowledge and designing", in *Design plus Research: Proceedings of the Politecnico di Milano Conference, May 18-20, 2000*, Milan (2000).

7 Bertola, op. cit. p.

8 See Penati, A., Seassaro, A., Bertola, P., "All'insegna dell'innovazione didattica. Il Corso di Laurea in Disegno Industriale del Politecnico di Milano", in Penati, A. (ed.), *Didattica & Design*, Polidesign Milano, 2000.

9 Schön designates the following as design professions: architecture, engineering, industrial design and software design. However, he analyses these professions insofar as they exemplify the design-grounded nature of all other kinds of practical activities.

10 Schön, ibidem (pp.16-7).

11 See Bertola P., "Il metaprogetto nella didattica del design", in Deserti, A. (ed.), *Metaprogetto, riflessioni teoriche ed esperienze didattiche*, PoliDesign, Milan, 2003.

12 Skogstad, Philipp L., Currano, Rebecca M., Leifer, Larry J., *An Experiment in Design Pedagogy Transfer Across Cultures and Disciplines*, *International Journal of Engineering Education*, Volume 24, Number 2, March 2008, pp. 367-376 (10)

13 Bushnell, T., Steber, S., Matta, A., Cutkosky, M., & Leifer, L. (2013, September). Using A 'Dark Horse' Prototype to Manage Innovative Teams. In 3rd International Conference on Integration of Design, Engineering and Management for Innovation.



