



unione italiana disegno

# DIALOGHI **DIALOGUES**

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*Testimoniare Comunicare Sperimentare*  
*Witnessing Communicating Experimenting*

43° CONVEGNO INTERNAZIONALE  
DEI DOCENTI DELLE DISCIPLINE DELLA RAPPRESENTAZIONE  
CONGRESSO DELLA UNIONE ITALIANA PER IL DISEGNO  
ATTI 2022

43<sup>rd</sup> INTERNATIONAL CONFERENCE  
OF REPRESENTATION DISCIPLINES TEACHERS  
CONGRESS OF UNIONE ITALIANA PER IL DISEGNO  
PROCEEDINGS 2022

a cura di/*edited by*  
Carlo Battini, Enrica Bistagnino



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Starlight Vattano

La città della Duplice Visione. Venezia nelle immagini di Raimund Abraham, 1978

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Maurizio Marco Bocconcinio, Ursula Zich, Martino Pavignano

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Alessandro Castellano

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Legi[a]bility, between graphics and inclusion

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Gerardo Maria Cennamo

Semantica del disegno tra evoluzione digitale e codici archetipali

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1432

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Representing the urban landscape: signs for a dynamic identity

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Eugenio Maria Falcone, Juan Saumell Lladó

Le radici del progetto. La rappresentazione dell'architettura.  
Ipotesi di una grammatica per una nuova semiologia applicata  
The roots of the project. The representation of architecture.  
Hypothesis of a grammar for a new applied semiology

1508

Francesca Fatta, Paola Raffa

Raccontare. Arte. Linguaggi creativi per l'infanzia  
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1530

Fabrizio Gay

Disegnare atmosfere: rifrazione semiotica di una salienza inglobante  
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1548

Fabrizio Gay

Il fulmine e la "reazione nera": disegno naturale e artificiale dei pattern tra Golgi e Simondon  
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Analysis and representation for Digital Humanities: la Mappa Mosaico di Madaba.  
Digitalizzazione, analisi, decostruzione  
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Digitalization, analysis, deconstruction

1590

Silvia La Placa, Francesca Picchio

Strategie per la rappresentazione dei segni e degli iconemi del paesaggio irriguo pavese  
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1608

Gaia Leandri

"Di-segno" manuale e "De-sign" digitale, una scelta di comunicazione visiva  
Freehand "Di-segno" and digital "De-sign", a choice of visual communication

1628

Novella Lecci, Alessandra Vezzi

Raccontare i reperti archeologici: un video olografico per la stele di "Auvele Feluske"  
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Gennaro Pio Lento

Il rilievo SAPR delle residenze reali di vacanza in Albania  
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Massimo Leserri, Carla Ferreyra, Andrea di Filippo, Caterina Gabriella Guida

Optimising 3D interactive exploration of open virtual environments on web, using mobile devices

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Representation: dialogue between drawing and theatre

1697

Valeria Marzocchella

Il forsennato paesaggio di Napoli. Foto e visioni interiori a confronto  
The frenzied landscape of Naples. Photos and inner visions compared

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Davide Mezzino, Riccardo Antonino, Enrico Ferraris

Rappresentare la ricerca: metodi e strategie di comunicazione visiva in ambito museale  
Representing the research: methods and strategies of visual communication in museums

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Carlos Montes Serrano, Sara Peña Fernández

Frank Lloyd Wright: Models in Exhibitions (1932-1949)

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Accumulazioni su Casa Palestra: abitare un'atmosfera  
Accumulations on Casa Palestra: Dwelling an Atmosphere

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Alice Palmieri

Narrazioni e interpretazioni grafiche: proposte per un progetto di identità visiva del Carnevale di Palma Campania  
Narratives and graphic interpretations: proposals for the visual identity project of the Palma Campania Carnival

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Alberi monumentali e giardini storici: un processo virtuoso di disseminazione e fruizione  
Monumental trees and historical gardens: a virtuous process of dissemination and fruition

1789

Spiros Papadopoulos, Vassilis Bourdakis, Elena Mantzari, Aristides Vagelatos, Apostolia Galani, George Loukakis

Designing VR and AR gamifications for cultural heritage educational escape games

1797

Leonardo Paris

Virtual tour. Anywhere and nowhere

1805

Marta Pileri

Il dialogo tra saperi per la comunicazione del patrimonio culturale  
The dialogue between knowledge for the cultural heritage communication

1821

Giovanna Ramaccini

Well-aging? Way-finding! La comunicazione ambientale per contesti age-friendly  
Well-aging? Way-finding! Design strategies for age-friendly environments

1835

Leopoldo Repola

Cuma. Declinazioni del digitale  
Cuma. Digital declension

1853

Felice Romano

Rappresentazioni vertiginose. Tre esempi: Perec, Lequeu, Douat  
Vertiginous representations. Three examples: Perec, Lequeu, Douat

1873

Jessica Romor

Prospettiva e visualità: il volere della ragione, il valore dell'intenzione  
Perspective and visuality: the volition of reason, the value of intention

1893

Michela Rossi, Giorgio Buratti, Greta Milino

Sinergie di linguaggi - figure e pattern per la retorica del metaverso  
Language synergies - Figures and patterns for the metaverse rhetoric

1909

Maria Elisabetta Ruggiero

Brand Identity e nuovi media. Il caso studio del Platinum Jubilee  
Brand Identity and new media. The Case Study of Platinum Jubilee

1927

Francesca Salvetti

Colour project as redevelopment of school environments. Colour and visual identity

1935

Nicoletta Sorrentino

La comunicazione visiva per il trasporto passeggeri navale: linguaggi, funzioni, criticità  
Visual communication for naval passenger transport: languages, functions, issues

1949

Michele Valentino

Dialoghi tra disegno e testo nelle opere di Rem Koolhaas  
Dialogues between drawing and text in Rem Koolhaas works

1961

Marco Vitali, Giulia Bertola, Francesca Ronco

Applicazioni di Motion graphic per la valorizzazione del patrimonio museale del Museo di Arte Orientale di Torino (MAO)  
Motion graphic applications for the enhancement of the heritage of the Museum of Oriental Art in Turin (MAO)

1980

Angela Zinno

Per una rappresentazione multimodale del testo drammatico: ipotesi e traiettorie di un processo creativo  
For a multimodal representation of the dramatic text: hypotheses and directions of a creative process

## SPERIMENTARE EXPERIMENTING

1996

*Fabrizio Agnello, Mirco Cannella, Marco Rosario Geraci*

Mostrare l'invisibile: il soffitto trecentesco nascosto del convento di Santa Caterina a Palermo

Displaying the invisible: the 14th century hidden ceiling in the convent of Santa Caterina in Palermo

2016

*Giuseppe Amoruso, Polina Mironenko*

L'ipermodello BIM per gli allestimenti museali: programmazione visuale delle librerie parametriche

The BIM hyper model for museum exhibits: visual programming of parametric libraries

2036

*Pasquale Argenziano, Alessandra Avella, Nicola Pisacane*

Il disegno delle gemme sfaccettate. Fonti iconografiche e trattatistica, analisi geometrica, rilevamento, modellazione parametrica

Faceted gemstones drawing. Iconographic and treatise sources, geometric analysis, survey, parametric modelling

2058

*Vincenzo Bagnolo, Andrea Pirinu, Raffaele Argiolas, Simone Cera*

Dal disegno all'edificio e ritorno. Strumenti digitali per comunicare gli archivi di architettura

From drawing to building and back. Digital media to enhance architecture archives heritage

2074

*Sara Gonizzi Barsanti, Santiago Lillo Giner*

Oppido Mamertina in 3D: dalla fotogrammetria alla ricostruzione digitale

Oppido Mamertina in 3D: from photogrammetry to digital reconstruction

2090

*Carlo Battini, Rita Vecchiattini*

Potenzialità e limiti di sistemi mobile per il rilievo 3D

Potential and limitations of mobile systems for 3D surveying

2106

*Fabio Bianconi, Marco Fillippucci*

KID. Il disegno di un nuovo tipo di bicicletta

KID. Drawing of a new type of bicycle

2130

*Maurizio Marco Bocconcino, Mariapaola Vozzola*

Strumenti e procedure per il rilievo metrico speditivo di fronti urbani: informazioni, misure e disegni di massima come ausilio alle abilità artigianali

Tools and procedures for the expeditive metric survey of urban fronts: information, measurements and rough drawings as an aid to craft skills

2149

*Marianna Calia, Antonio Conte*

Visioni per ri-abitare i patrimoni fragili: sperimentare architetture nello spazio pubblico e nel paesaggio

Visions for re-inhabiting fragile heritages: experimenting with architecture in public space and landscape

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*Massimiliano Campi, Valeria Cera, Marika Falcone, Mario Ferrara*

La rappresentazione del territorio peri-urbano tra city modelling, rilievo e fotografia

The representation of the peri-urban territory between city modelling, survey and photography

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*Cristina Cándito*

Spazialità e orientamento nelle architetture ipogee, tra configurazione e rappresentazione

Spatiality and Orientation in Hypogean Architectures: between configuration and representation

2199

*Mara Capone, Angela Cicala*

Dalle "macchine inutili" alle "macchine utili". Algoritmi generativi per costruire le geometrie della trasformazione

From "useless machines" to "useful machines". Generative algorithms to build transformation geometries

2221

*Matteo Cavaglià, Lorenzo Ceccon, Luigi Cocchiarella, Thomas Guido Comunian, Veronica Fazzina, Giulia Lazzaretto, Alessandro Martinelli, Caterina Morganti, Giulia Piccinin, Simone Porro, Lorenzo Tarquini, Nicolas Turchi*

Digi Skills Bsc – Revising Graphic Literacy in Bsc Architectural Design Education through a Software-Based Pedagogic Approach. A Shared Pilot Experience at the Politecnico di Milano

2230

*Santi Centineo*

"Uno scheletro di teatro". L'esperienza teatrale di Alberto Burri e il Teatro Continuo

"A theatre skeleton". The theatrical experience of Alberto Burri and the Teatro Continuo

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*Enrico Cicalò, Valeria Menchetelli*

Psico-grafica. Dialoghi tra le scienze grafiche e le scienze psicologiche

Psycho-graphic. Dialogues between the graphic sciences and the psychological sciences

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*Pierpaolo D'Agostino, Giuseppe Antuono, Pedro Vindrola*

Ricostruzione e fruizione digitale di paesaggi perduti. Visioni di Palazzo d'Avalos in Procida

Digital reconstruction and fruition of lost landscapes. Views of Palazzo D'Avalos in Procida

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*Saverio D'Auria, Erika Elefante, Maria Ines Pascariello*

Frammenti urbani e nuove visualizzazioni: la piazzetta di San Gennaro all'Olmo a Napoli

Urban fragments and new views: the square of San Gennaro all'Olmo in Naples

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*Fabrizio De Cesaris, Francesca Porfiri, Luca J. Senatore*

Il Rilievo per l'emergenza: il caso di Palazzo Pallotta a Caldarola

Emergency survey: the case of Palazzo Pallotta in Caldarola

2324

*Raffaella De Marco*

La Forma strutturale: opportunità di articolazione topologica delle mesh geometriche al processo di conoscenza e simulazione in Architettura

The Structural Form: opportunities for a topological articulation of geometric meshes to the process of knowledge and simulation in Architecture

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*Giuseppe Di Gregorio*

Tra reale e virtuale: il medievale castello di Mussomeli

Between real and virtual: the medieval castle of Mussomeli

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*Francesco Di Paola, Sara Morena, Sara Antinazzi*

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*Tommaso Empler, Fabio Quici, Adriana Caldaroni, Elena D'Angelo, Alexandra Fusinetti, Maria Laura Rossi*

HBIM e ICT. Il BIM per la valorizzazione della Fortezza Pisana di Marciana

HBIM and ICT. BIM for valorize Pisan Fortress of Marciana

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*Elena Eramo*

Sul rapporto semantico tra dati grafici e numerici in un modello di valutazione del Rischio archeologico

The sematic relationship between graphic and numerical data in an archaeological heritage Risk assessment model

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*Sara Erliche, Giulia Pellegrini*

Cultural heritage survey and inclusive representation. The case of Villa Ottolenghi

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*Jesús Esquinas-Dessy, Isabel Zaragoza*

Diálogos con el lugar. Experimentando nuevas maneras de mirar y re-presentar

Site talks. Experimenting new ways of seeing and re-presenting

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*Mariateresa Galizia, Graziana D'Agostino*

Il rilievo e la rappresentazione del Teatro Sangiorgi di Catania, testimonianza e memoria documentale di usi e costumi del Novecento

The survey and representation of the Sangiorgi Theatre in Catania, testimony and documentary memory of 20th-century customs and traditions

2459

*Noelia Galván Desvaux, Pablo Cendón Segovia, Marta Alonso Rodríguez, Raquel Álvarez Arce*

Microorganismos marinos como fuente de inspiración y materia prima de la arquitectura: Richard Neutra y la serie Diatom

Marine microorganisms as a source of inspiration and raw material for architecture: Richard Neutra and the Diatom series

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Visualizzare la conoscenza. La rappresentazione delle reti citazionali internazionali nell'ambito delle scienze grafiche  
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Marco Limongiello, Angelo Lorusso, Anna Sanseverino, Barbara Messina  
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Predictive preservation of historic buildings through IoT-based system
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Andrea Lumini, Federico Cioli  
La rappresentazione del suono. Rilievo digitale e modellazione 3D per la virtualizzazione multisensoriale di tre grandi teatri europei  
The representation of sound. Digital survey and 3D modeling for the multisensory virtualization of three major European theaters
- 2645**  
Tomás Enrique Martínez Chao  
Processi di segmentazione e classificazione di viabilità urbana tra analisi ed accessibilità  
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- 2661**  
Marco Medici, Federico Ferrari, Andrea Sterpin  
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Architettura e Distruzione. Sperimentazioni sui disegni di Lebbeus Woods  
Architecture and Destruction. Experimentation on drawings by Lebbeus Woods
- 2698**  
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In media res. Il ruolo del rilievo urbano nel PCRI tra Caletta di Castiglioncello e Lillatro (Rosignano Marittimo)  
In media res. The role of urban relief in the Settlement Redevelopment Complex Programme (PCRI) between Caletta di Castiglioncello and Lillatro (Rosignano Marittimo)
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- 2724**  
Alessandra Pagliano, Annalisa Pecora  
An immersive experience for the room with agrestic paintings in Carditello (CE)
- 2734**  
Maurizio Peticarini, Alessandro Basso  
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- 2751**  
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# Digi Skills Bsc - Revising Graphic Literacy in Bsc Architectural Design Education through a Software-Based Pedagogic Approach. A Shared Pilot Experience at the Politecnico di Milano

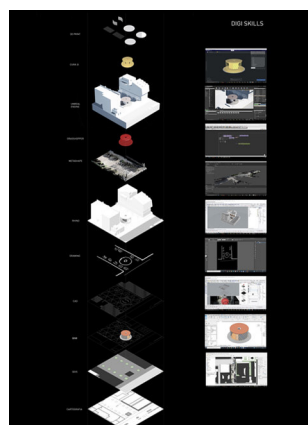
Matteo Cavagliá, Lorenzo Ceccon, Luigi Cocchiarella, Thomas Guido Comunian, Veronica Fazzina, Giulia Lazzaretto, Alessandro Martinelli, Caterina Morganti, Giulia Piccinin, Simone Porro, Lorenzo Tarquini, Nicolas Turchi

## Abstract

Inspired by the UNESCO/UIA Charter for Architectural Education (Tokyo 2011), since 2020 the digital literacy programme Digi Skills BSc (4 ECTS) is offered to the 2nd year of the Bachelor in Architectural Design at the Politecnico di Milano. Addressed to students who already have a background in classic graphic representation, it aims at experimenting with a paradigm shift from analog to digital, in line with both traditional disciplinary fundamentals and the operational routines characterizing architectural design processes and workflows nowadays. Given the relevance of space in architectural education, 3D geometry-based modeling is the essential chapter in the syllabus. However, an introduction to the parametric and BIM workspaces, as well as some basics of data input (by device, from geoportals and point clouds) and output (visual editing, graphic and physical prototyping) are included as well. Dealing with a variety of software programs and file formats responds to the most challenging UNESCO/UIA expectation that «digital fluency» is encouraged in architectural education. It also led to excellent feedbacks by the about 1.000 students involved. Engaging young generations of scholars from various Universities in the tutorship of the classes (MSc graduates, PhD students and graduates, young researchers), recruited through a national annual call, also published on the UID webpage, was a bet. After two years, it seems to have coagulated into a novel promising research group, which, among other things, also suggested writing this co-authored paper.

## Keywords

Digital technologies, dystopia, graphics education, visual representation, distance learning



DigiSkills BSc at Polimi: digital fluency at work, a graphic synopsis (original materials from the course).

- CURA3D
- UNREAL ENGINE
- GRASSHOPPER
- METASHAPE
- RHINOCEROS
- ILLUSTRATOR
- RHINOCEROS
- REVIT
- QGIS



## Introduction

Although the idea of revising curricula in architectural graphic representation spans a couple of previous decades, the 150<sup>th</sup> anniversary of the Politecnico di Milano in 2013 offered the chance of discussing the topic in an international and interdisciplinary talk on «The Visual Language of Techniques» [Cocchiarella, 2015]. After a while, an advanced Digi Skills programme addressed to the master's level appeared, mainly focusing on parametric modeling and BIM (fig. 01). More problematic was the implementation of our basic Digi Skills BSc programme addressed to the Bachelor level, due to the necessary connections with analogue graphics literacy as an essential prerequisite. However, in the AY 2020/2021 it was finally decided to start. After two years this work aims to offer a co-authorial retrospect on this experience by the teaching group. The programme is organized in the form of tutorships coordinated by a responsible teacher. In the AY 2021/2022 students were distributed in 20 classes of about 50 students, each taught by a tutor. Despite the short time available (4ECTS), the course would offer a certain systematic approach to the digital processes supporting the real making of an architectural project from concept to form definition and presentation (fig. 02), also related to a narrow urban context. In order to keep a coordinated schedule, the 20 classes worked on the same assignment, that is, a small pavilion ideally located near the entrance to our School.

## DIGI SKILLS BSc CONCEPT DIAGRAM

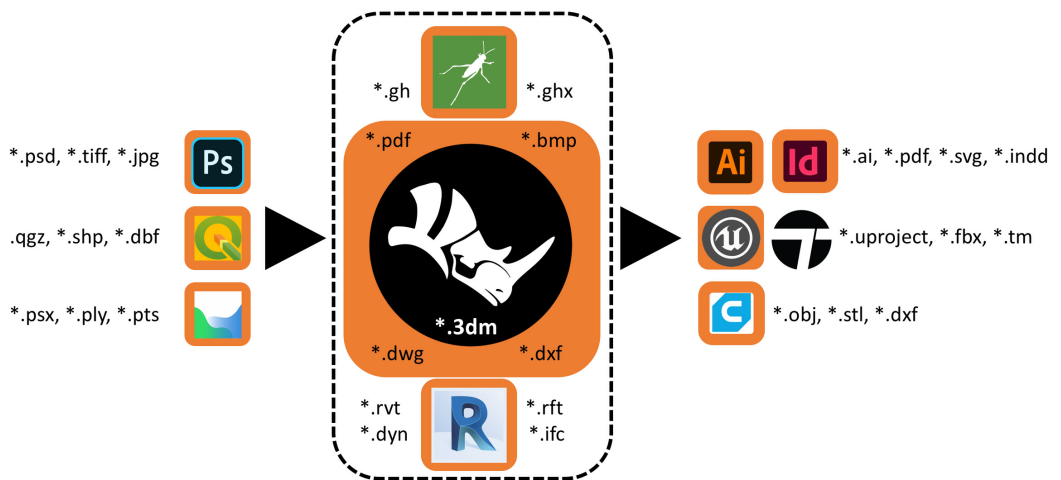


Fig. 01. Digi Skills BSc concept diagram: educational goals through a digital workflow (original materials from the course)

## WORKFLOW

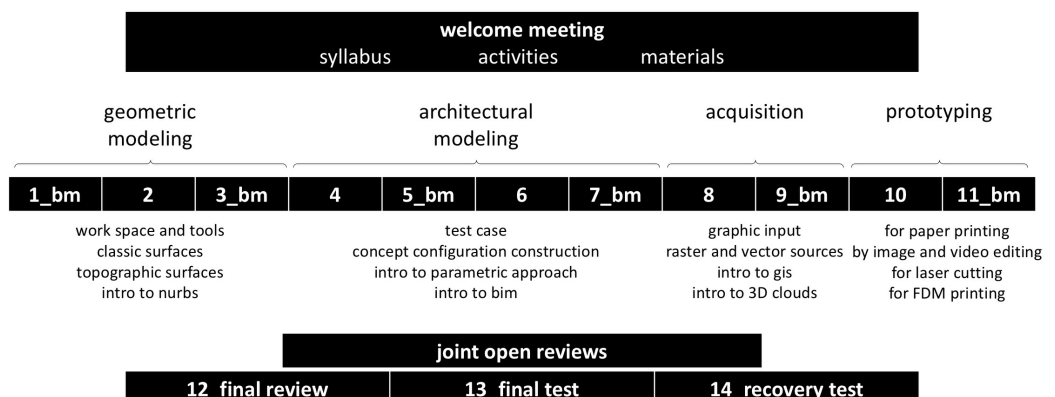


Fig. 02. Digi Skills BSc workflow: weekly schedule with contents, letter "bm" stands for plenary meetings of the coordinator with the tutors (original materials from the course)

A plenary meeting with tutors was organized by the responsible teacher biweekly, and tutors were provided weekly with digital ready-made materials for the lectures. During the semester, joint office hours were scheduled with the available tutors. Since distance-learning resulted in being of great help for the coordination and management of the course activities with such a high number of students, we decided to keep it even for the future. A cultural context dominated by the rapid evolution of the digital field encourages a «conscious approach» to computer graphics, based on key principles and updated procedures, to which the proposed *skills* must refer. In our educational view Digi Skills BSc, as a digital graphics literacy programme, should look at a dual goal: offering an alternative way to 'stray' self-directed approaches to the digital tools in the University, and providing acceptable bases for collaborative work and interdisciplinary cooperation in the field of architectural design [Hemmerling & Cocchiarella 2018]. Indeed, according to the UNESCO/UIA recommendations, «digital fluency» may offer excellent bases to open communication channels, for the benefit of both the interdisciplinary exchanges and cooperation, which are maybe the most appropriate educational goals for such a programme in the educational context of a School of Architecture Urban Planning Construction Engineering [Cocchiarella 2021, pp.25-49]. In the following paragraphs, we will propose a series of reflections on specific issues, in order to devise a lifelong learning paradigm also based on a student feedback process, as well as new ideas. At the end of the semester, some students' homework have been selected as «best of» examples in each class, and published on work gallery of the official website of the Bachelor in Architectural Design (fig. 03).

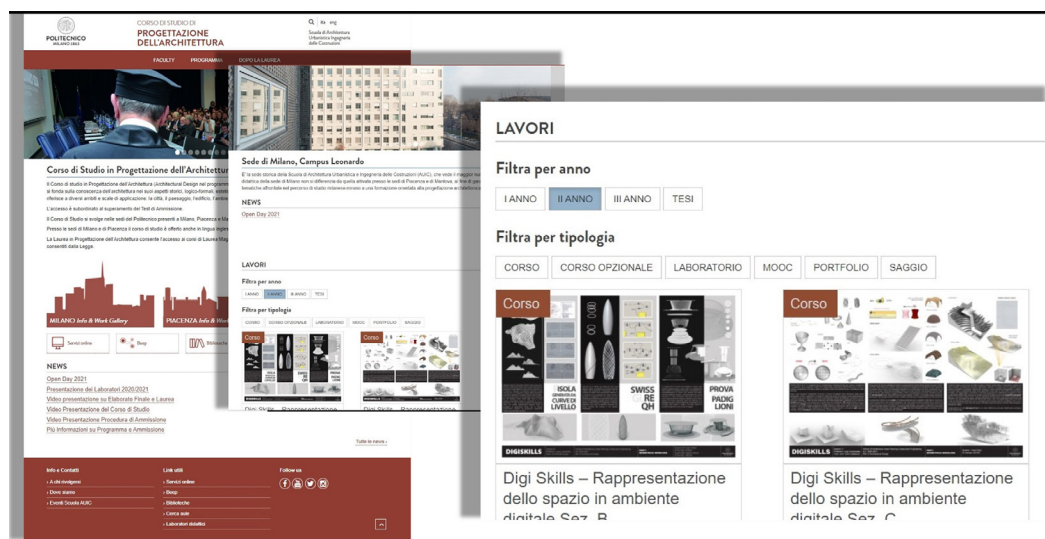


Fig. 03. Digi Skills BSc outcomes: selection of students' works «best of» as it appears on the official webpage of the Bachelor Programme Architectural Design, available in Italian and English [http://www.progettazione dellarchitettura.polimi.it/en/]

## State of the art

Aiming at finding and experimenting with an optimal formula based on a codified, disseminable and interoperable teaching method for smart education in digital literacy courses, to be carried out by digital means, a quick look at the state of the art in this field may be of help, besides referring to our experience. The debate about the correct use of digital tools within the educational path and its criticalities vis-à-vis an in-depth preparation of the students was already born in the 90s [Marx 2000, pp. 19-35]. However, it clashes with the potential of the medium, now more established and widespread. The early adoption of such means in the educational study course offers new forms of involvement, and are not limited to offering new creative/planning tools, but also help develop more innovative ideas as well as increase the student awareness of the potential of the tools themselves [Appiah & Cronjé 2014, pp. 85-94].

Hence, the importance of a course that offers an overview of the various available software environment and materials. In fact, several branches of research on education in the architectural sector have already investigated the possibilities of digital tools, with positive feedback on the understanding of notions, acquisition of skills, and competitiveness [Shiratuddin & Fletcher 2007]. On the other hand, other studies highlight the problems related to the excessive focus on aesthetics, the loss of critical sense, and the need for tools that lead the student to correctly evaluate the project. [Guneş 2015, pp. 757-765]. In this sense, a comprehensive training providing an overview of today's BIM and parametric systems could compensate for any compositional bias. On the other hand, the forced transition of the academic sector to online teaching in response to CoVid-19, ignited the debate on the quality and compliance of education. Compared to traditional techniques, remote teaching does not seem to fit workshop and teamwork settings [Motley 2017, pp. 229-240], because of the absence of in-person team interaction and direct contact with the teacher; less design practice and live corrections. Furthermore, research showed that workshops were among the most debilitated courses, as their essential experiential-cognitive aspect was missing [Ibrahim et al. 2021, pp. 2345-2353]. However, it has been shown that the teaching of digital tools gains its maximum efficiency through the use of the computer systems themselves [Alhajri 201, pp. 422-425], whereby the students can practice both during the course hours, and autonomously, assimilating secondary notions [Fraher & Martinson 2011, pp.390-412]. The general opinion in the literature on digital design education has raised a series of concerns, ranging from the possible loss of creativity due to standardized means, to its excess fueled by tools that move away from functional judgment. Therefore, this paper aims to verify whether the proposed bachelor course can stay clear of such shortcomings.

## Methodology

It is possible to consider Digi Skills as an effective tool to introduce new educational forms in the university system. The online lectures and the possibility to record and review them became the main strongholds of the course and allowed Digi Skills to be accessible to a high number of autonomous students. The experimented methodology allowed us to find a new schedule based on a wide range of software packages that inevitably leads to making the digital approach the real topic. Meanwhile, design and descriptive geometry are taught in parallel and dependent on them. Moreover, the digital approach is based on three main phases: input, i.e. data acquisition; geometric, parametric and BIM modeling; output as visual, graphic and physical prototyping. The three phases are not to be considered separated, rather parts of a single workflow on multiple levels (fig. 04). In addition, the teaching methodology adopted for Digi Skills is based on the learning by doing approach, whereby the students taking part in the lectures are guided to work, independently from one another, on the same project at the same time. An ongoing dialogue between tutors and students is made possible by remote communication platforms overcoming the limits imposed by physical distances. Even with the size of the course, it is important to underline the management of every tutor, who refers to a programme defined and organized in topics and lectures, but free to develop their classes, to schedule student's submissions and manage relationships with students. Finally, we adopted a series of analysis tools to test the results of the course. First, on a weekly basis, students were required to submit assignments related to the classes' topics, which allowed a detailed evaluation of each student's progress along the course. Secondly, they also had to submit a final portfolio – containing the sequence of the topics touched along the course – showing the overall acquired knowledge as well as the proficiency level for each software package. Lastly, at the end of the course, each tutor selected the best final portfolio, informally called "Best Of", as a means to acknowledge the best students' efforts, thus fostering competition among the participants. Even if weekly submissions, portfolio and "Best Of" are important methodological tools, a final exam provides the definitive assessment of the level of competencies achieved by the students.

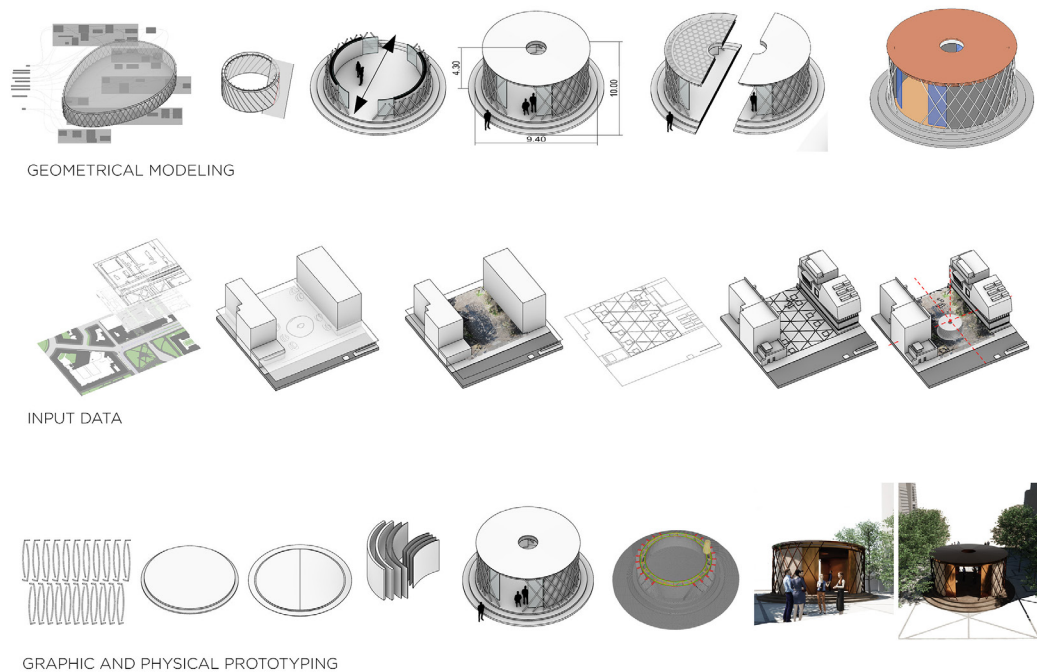


Fig. 04. Fig. 04. Didactic graphic elaboration of the 3 main phases: data acquisition; geometric, parametric and BIM modeling; visual, graphic and physical prototyping (original materials from the course)

Unlike most other courses and workshops such final evaluation is not graded rather is just a pass/fail evaluation vis-à-vis the minimum level of required competencies. In fact, we wanted students to experiment with the software packages freely, without thinking at the final evaluation.

### Trials and results

A double retrospective analysis- by- survey of the educational activities is presented here, concerning the students' and tutors' points of view. The survey addressed to the "students group" dates back to the end of the first edition of the Digi Skills courses held in 2020/2021, while the one addressed to the "tutors group" was completed at the end of the second edition, referring to the academic year 2021/2022. Architecture students, who took part in the Digi Skills courses online during the lockdown in 2020, were invited to complete an online survey. The number of students who responded was 547. Figure 05 shows their answers to 9 out of the 11 questions submitted by a simple choice questionnaire with "yes" or "no" as possible answers. Here is a short comment on the results. Q.01. 94,8% of the students consider the inclusion of this course in the study plan as positive. Q.02. 98% of them stated to have acquired new knowledge and skills. Q.03. 92,4% appreciate the fact that this course addressed the use of various software packages and focused on the links among them. Q.04. Only 5.8% express that knowledge and skills acquired in this course didn't improve their ability to understand and represent the three-dimensional space of architecture. Q.05. 80% of the students report having changed their vision about digital representation in architecture. Q.06. 90% of them think that knowledge and skills acquired are effectively usable right away in other courses. Q.07 88% think that what they learned in the course has in some way affected, or could affect, their approach to architectural design. Q.08. Only 13,8% of the students consider negatively the distance learning experience for this course, while 86,2% express positive opinions on this point. Q.09.



### Final survey on the Digi Skills Bachelor experience

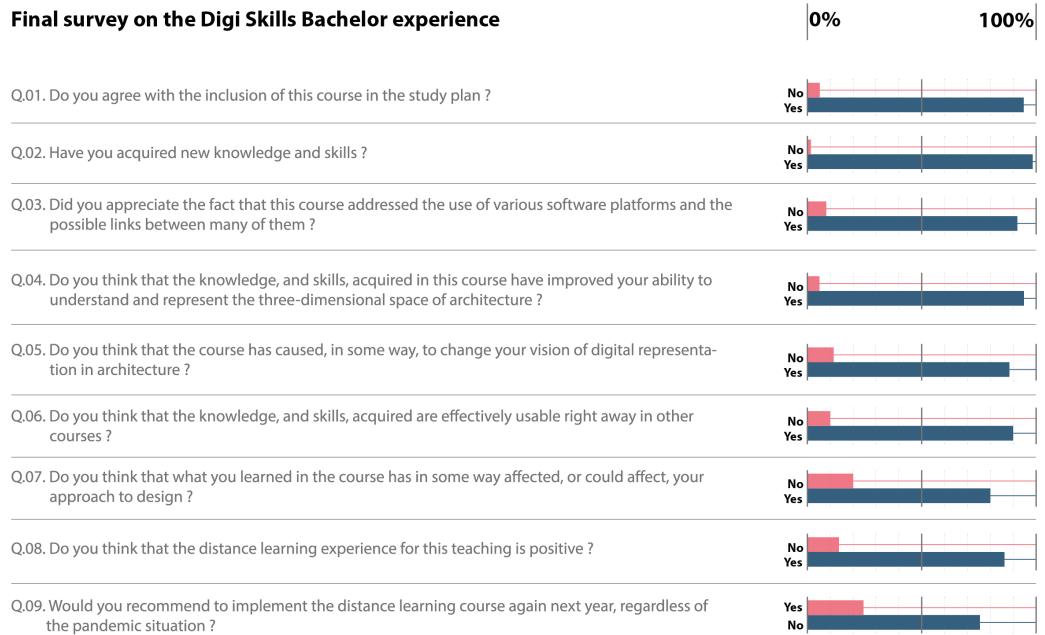


Fig. 05. Students' opinion: summary of the answer trends on some relevant aspects of the courses, AY 2019/2020\_(elaboration by the teaching board)

Indeed, 75% recommend to maintain the remote learning modality for next year, regardless of the pandemic situation. Summarizing the analysis, data gleaned from this study indicate high levels of satisfaction with the programme and educational results as well as with the online learning experience.

The second survey (figs. 06, 07), involving the tutors, was inspired by the use in literature for the analysis online learning (Ref), including teaching monitoring.

Tutors who taught online Digi Skills courses in 2021 have been asked to provide an assessment of their teaching semester, particularly as to some of the tested aspects, such as communication with the class, perception of the class involvement on the topics, teaching organization, communication within the tutoring team, and organizational skills.

Digi Skills Tutors were invited to rate the statements in the survey using both a 6-point (from 0 to 5) scale and an 11-point (from 0 to 10) scale, as well as closed answers.

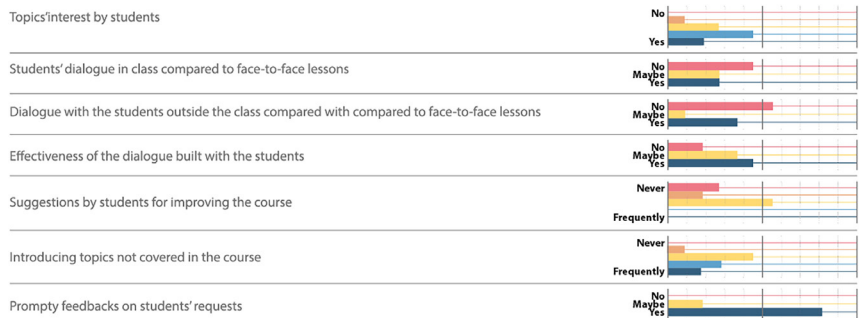
Observing the results of the tutors group survey, we can notice that communication with the class and the perception of class involvement on the topics, helped them to check students' understanding about the goals. Our survey findings offer a novel perspective regarding communication with the class and with the team, and organizational skills. In fact, 100% of the respondents express satisfaction with the coordination of the work through meetings, arranged biweekly by the coordinator, for the gaining of new knowledge, and also for the effectiveness of the use of remote communication tools in mutual aid among tutors.

Observing the organization of teaching results, we can observe that more than 50% of tutors spent time on extra checks during the exercises and dedicate more time for software programmes like Grasshopper and Metashape. 80% of them also recognize the effectiveness of collective reviews.

As to the time allotment between teaching and interaction with students, more than 40% of the time has been spent on average on the exercises' discussion, and about 20% of time on the homework assignment. Another survey section, regarding the evaluation of results and evaluation methods, shows where tutors need to work to improve the expected results. For example, it shows where the major difficulties lie in the verification of students' homework, and which software packages result particularly difficult for students to learn and apply. Taken together, students' and tutors' group surveys may offer a novel perspective on class goals and outcomes.



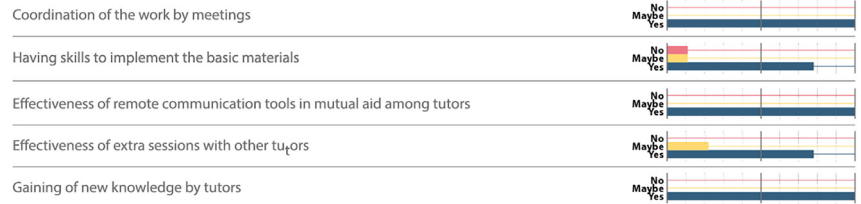
### Perception of class involvement on the topics



### Organization of the teaching



### Team communication and organizational skills



### Evaluation of results and evaluation methods

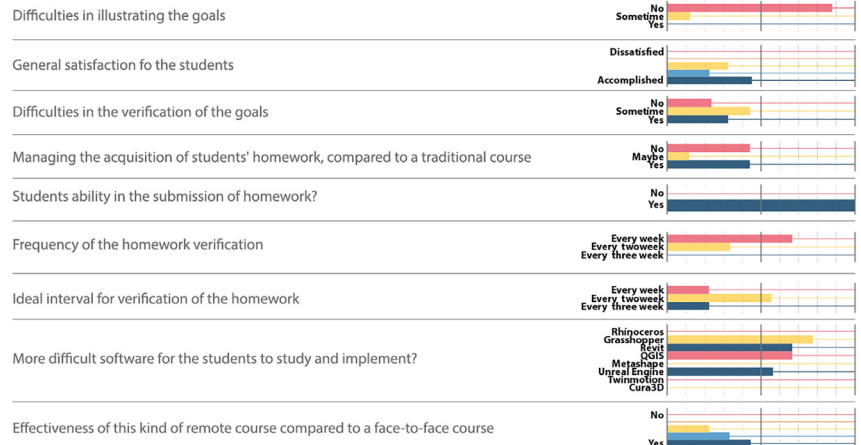


Fig. 06. Tutors' survey results part 1: answer trend summary on some relevant aspects of the courses, AY 2021/2022 (elaboration by the teaching board)

Fig. 07. Tutors' survey results part 2: answer trend summary on some relevant aspects of the courses, AY 2021/2022 (elaboration by the teaching board)

## Potentiality

Digital proficiency, being solidly acknowledged as a universal language, is set to be established as a central component of the Politecnico di Milano curricula and will foster the school mission to be at the forefront of academic didactical advancement and scholar research. Both the distinctive comprehensiveness of the course and the success of its English version in the schools based in Mantova and Piacenza, highlight the scalable nature of a module that could possibly span across several schools and beyond national borders, reinforcing current and future international mobility programs, especially within the EU. Furthermore, the hybrid modalities of teaching and the course flexibility allow for hiring of international profiles, thus enlarging the school network and bringing diversity within members of the faculty of the School. These as well as other potentialities that became tangible during the first couple of academic years will need to be monitored closely in the near future, especially those relying upon feedback data received from the bachelor's and master's experiences.

## Conclusions

Digi Skills represents a new frontier in both academic teaching and scientific research. The constant and simultaneous interaction with a wide range of modeling and prototyping software programmes allows students to immediately acquire new knowledge, and to relate themselves with the tutor, whose teaching skills and knowledge about the software, as well as the representational subject itself, increase in turn. It becomes a two-way exchange relationship where the infinite variables and solutions relating to a problem become fertile ground for knowledge and learning. Many students, in fact, succeed, class after class, in acquiring a broader software awareness, and begin to grasp software logic by solving the problems that the lesson requires. The course takes on the role of a workshop/atelier where knowledge is «modeled» to build and acquire new skills and new tools, necessary to interface with a working world increasingly focused on “digital fluency” and on the operational competence of professionals and architects working in the sector.

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