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The Sustainable City XVI

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SUSTAINABLE CITY XVI

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Preface

The present volume contains a selection of the papers presented at the 16th International Conference on Urban Regeneration and Sustainability (Sustainable City 2022), organised by the Wessex Institute of Technology. This conference was originally scheduled to take place in Rome, in Italy, but subsequently had to be held online due to political and military situation in Europe and some remaining steps of the COVID-19 pandemic.

Sustainable City 2022 follows a series of very successful meetings that started in Rio (2000), followed by Segovia (2002), Siena (2004), Tallinn (2006), Skiathos (2008), A Coruña (2010), Ancona (2012), Kuala Lumpur (2013), Siena (2014), Medellin (2015), Alicante (2016), Seville (2017) and Valencia (2019). Editions of 2020 and 2021 was programmed in Rome and Bilbao respectively but took place online due to the difficulties and prohibitions for travelling generated by the pandemic. Nevertheless, both the in person and the online version of the events have attracted a large number of delegates as well as papers and presentations of high quality; this testifies to the worldwide interest in and success of the conference series.

Urban areas result in a series of environmental challenges varying from the consumption of natural resources and the subsequent generation of waste and pollution, contributing to the development of social and economic imbalances. According to current trends, the population is concentrating in urban areas that continue to grow all over the world. Old and new problems tend to become more acute and require the development of innovative solutions to create liveable urban areas without endangering our common future.

The task of researchers is to improve the capacity to manage human activities, pursuing welfare and prosperity in the urban environment. Any investigation or planning in a city ought to consider the relationships between the parts and their connections with the living world. The dynamics of its networks (flows of energy-matter, people, goods, information and other resources) are fundamental for an understanding of the evolving nature of today's cities.

Coastal areas and coastal cities are an important issue at the conference as they have some specific features. Their strategic location facilitates transportation and the development of related activities, but this requires the existence of large ports, with the corresponding increase in maritime and road traffic and all of the inherent negative effects, and can be directly affected by the rise in sea level. This requires the development of well-planned and managed urban environments, not only for

reasons of efficiency and economics but also to avoid inflicting environmental degradation that causes the deterioration of natural resources, quality of life and human health.

Urban agriculture and food sovereignty are crucial issues that have been included in the conference due to their impact on city life. The scale of modern food production has created and exacerbated many vulnerabilities and the feeding of cities is now infinitely more complex. In the last few years, there has been a rapid expansion in initiatives and projects exploring innovative methods and processes for sustainable food production. The majority of these projects are focused on providing alternative models that shift the power back from the global food system to communities and farmers improving social cohesion, health and wellbeing. These initiatives have demonstrated that urban agriculture has the potential to transform our living environment towards ecologically sustainable and healthy cities.

Large cities represent a fertile ground for architects, engineers, city planners, social and political scientists, and other professionals able to conceive new ideas and time them according to technological advances and human requirements. Their works are essential in order to help public policies progress and become more committed to environmental challenges.

The contents of the book corresponds to a very wide ranges of topics, among them: Architectural issues, environmental management, planning for risk, climate change and natural hazards, the community and the city, urban transportation and planning, energy conversion and generation, urban agriculture and food sovereignty, city/waterfront interaction, waste management, cultural heritage sites and urban and rural areas. So it supposes an important addition to the scientific literature in this field.

For this reason, the papers contained in this book, as well as those from previous conferences since 2000, have been archived in the eLibrary of the Wessex Institute (http://www.witpress.com/elibrary) where they are permanently accessible to the international scientific community.

The editors wishes to acknowledge the support of the authors, the members of the International Scientific Advisory Committee (ISAC), the referees, Marta Graczyk, the conference co-ordinator, as well as the WIT Press staff and Isabelle Rham, in particular.

Finally, the editors and ISAC members wish to honour the memory of the late Professor Carlos Brebbia, founder of Wessex Institute, who established this series of meetings having foreseeing its impact and appeal.

The Editors, 2022

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DESIGNING "CLOUDS" FOR A FLEXIBLE USE OF EDUCATIONAL SPACE: RESEARCH AND DIDACTIC EXPERIMENTATION FOR PUBLIC ENGAGEMENT IN THE POST-PANDEMIC ERA

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ABSTRACT
As part of the curriculum of the courses "Materials and Design of Building Elements" and "Urban Planning I", first-year students of the undergraduate programme in Architecture at the Department of Architecture of Pescara, together with undergraduate students from the "Design and Construction" undergraduate laboratory, were involved in an experimental design and construction activity. The project was based on the innovative use of digital design and fabrication techniques and sustainable materials for the design and construction of small buildings, the "Clouds", whose social aims respond to the post-pandemic condition. The laboratory's experimentation and research activity, coordinated by professors Daniela Ladiana and Piero Rovigatti of the Department of Architecture in Pescara, and visiting professor Camilo Cifuentes of La Salle University in Bogotà, Colombia, focused on designing structures to support cultural activities in schools or educational spaces in neighbourhoods characterised by high dropout rates and educational poverty. The small buildings proposed in the final elaborations of the courses respond to the requirements of lightness, ease of construction and reversibility to facilitate self-construction by school communities. The work focused not only the content but also on teaching methods, implemented through a process of comparison and collaboration among students from different courses and levels. A further phase of work, for the construction of models and verification of the technical and economic feasibility of the project, involved local companies.
Keywords: schools, educational poverty, culture-based urban regeneration, low-cost functional upgrading, digital design and fabrication, teaching based on digital and real models.

1 INTRODUCTION

Schools have always represented the space delegated, by statute and institutional mission, with promoting in children the discovery and practice of various forms of cultural expression. This process naturally begins with reading, followed by all that concerns culture in its most open and inclusive expression. According to the Treccani Dictionary, a school is in fact an "institution of a social character which, through organised and structured teaching activity, tends to provide education, human and cultural training, specific preparation in a given discipline, art, technique, profession" [1].

The Latin origin of the Italian word for school – *scuola* – is also interesting: "scuòla" (pop. or poet. *Scòla*) s. F. lat. *Schŏla*, from the Gr. *Σχολή*, which originally meant (as *otium* for the Latins) "free and pleasant use of one's strengths, especially spiritual ones, independent of any need or practical purpose, and later a place where one attended to study".

"Play" is, again according to the definition found in the Treccani Dictionary, "any freely chosen activity to which children or adults devote themselves, individually or in groups, without any other immediate purpose than recreation and leisure, developing and exercising at the same time physical, manual and intellectual abilities" [2].

Observed from this particular point of view, it is difficult, however, to recognise, today, in the albeit exemplary organisation of Italian schools, the presence of spaces and equipment where students can exercise this free and pleasant use of their strengths. If we agree on

assigning play this characteristic, trying to thematise and explore this aspect of school activity becomes particularly interesting, also in light of the difficult and complex experience of teaching during the time of COVID-19 [3].

The "INsegnalibro Clouds" project was promoted within an urban regeneration programme devised by the Pescara Department of Architecture, as part of an extended partnership involving public and private third sector subjects. The project stems from the idea of testing, within the project partner schools, innovative spaces and devices dedicated to fostering and exploring these cultural practices also in a playful and creative sense. The idea was to open them up – from concept to construction – to creative contributions from the final users of these spaces, namely children. *INsegnalibro* was in fact conceived as a cultural-based regeneration project, primarily for children living in socially marginalised neighbourhoods in the suburbs of Pescara.

INsegnalibro is, therefore, a project of investigation, discovery, urban reconnaissance and storytelling. The project was designed to reactivate and establish a network of sites of shared culture for the rebirth of Pescara's Rancitelli, Villa del Fuoco, Fontanelle and San Donato neighbourhoods. The project began in January 2020 and ended in June 2021, with the F. Di Giampaolo library, Neighbourhood House. Starting from the basic hypothesis of the Urban Future Culture Plan, promoted by the Italian Ministry of Culture: "Culture that generates beauty, and regenerates places and social relations", the project attempted to implement it through a varied and complex programme of actions, both tangible and intangible, involving a large number of associations, schools, cultural and academic institutions and ordinary citizens, developing a network that has already been active in the neighbourhoods for some time [4].

INsignalibro project, community narratives

Responsabile scientifico e coordinamento di progetto
Piero Rovigatti, DdA

Operations and support group for activities in schools
Ludovica Simionato, Paola Lavorgna, con Asia Fusco e Mirella Perrone

Schools and related associations
Comprensivo Pescara 1 (Teresa Ascione, Assunta Negro, Maurizio Carafelli, Anna Paola Pizzolante); *Istituto MIBE* (Raffaella Cocco, Donatella Nubile, Daniela Giampaolo); *Istituto Manthonè* (Michela Terrigni, Camillo Giammarco); *PAS* (Dario Tiberio, Giorgia Ranieri, Martina Graziani); *Comitato di Quartiere. Per una nuova Rancitelli* (Francesca di Credico, Daniela Lariccia); *Garage Lab* (Francesco Calandra e Maria Grazia Liguori)

Site web: https://www.bibliotecacasadiquartierepescara.it

Figure 1: The working team and the associations involved in the "INsegnalibro" project.

Figure 2: "Literary Clouds": the location points of the concept, design and building workshops.

2 PUBLIC ENGAGEMENT FOR PRIMARY SCHOOLS

2.1 The "INsegnalibro" clouds project

Schools are among those structures most affected by the COVID-19 restrictions. An analysis of data concerning schools has exposed a concerning amplification of educational poverty and dropout out rates produced by the pandemic. It is now clear that the time spent away from school, from the school community, has carved out a deep and difficult to bridge furrow for this generation of students. This situation imposes the need to identify short-term solutions capable of multiplying the opportunities for meeting, studying, sharing content and discussion, to reverse current phenomena, particularly in economically and socially fragile neighbourhoods.

During the pandemic, research and didactic experimentation at the Department of Architecture of the "Gabriele d'Annunzio" University of Chieti and Pescara looked at the theme of public engagement related to the emerging critical issues faced by the area's schools. The intent was to define possible interventions for the redevelopment of schools and important places for the education community in the Rancitelli, Villa del Fuoco, Fontanelle and San Donato districts.

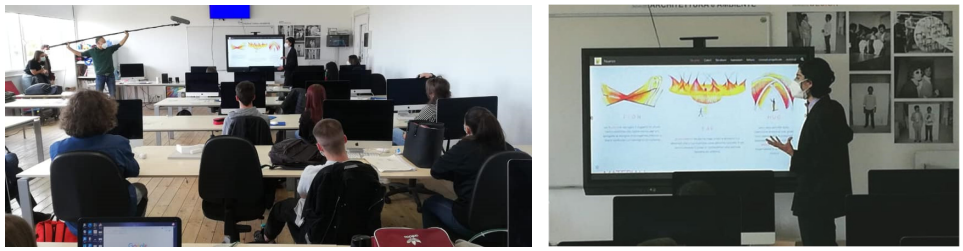


Figure 3: Creation of a "Literary Cloud" by students from the MIBE Art School.

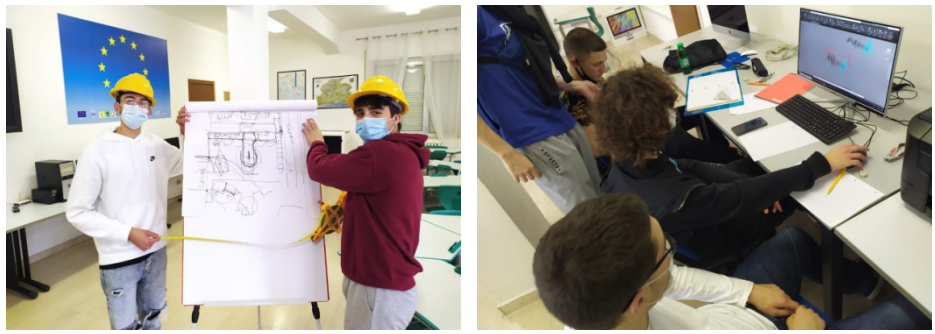


Figure 4: Creation of a "Literary Cloud" by students from the Manthonè Technical Institute.

The didactic experience described here, for the concept and construction of the "Clouds", was developed as part of the activities organised and promoted by the INsegnalibro project, for the networking of places for cultural sharing and the rebirth of neighbourhoods. The project focused on defining immediate, simple and potentially effective actions, primarily for children and adolescents living in these neighbourhoods. The aim was to defend their basic rights, such as access to education and play, services and urban commons, to counter rising educational poverty and support opportunities, well-being and social redemption.

The "Literary Clouds" represented one of the most challenging actions: the first phase involved designing and setting up spaces, together with children and young people from the participating schools, and the production of devices that serve the most basic cultural activities – reading a book, listening to music, attending a small theatre, music or film event – all within existing schools and their often vast and unadorned outdoor spaces, now of particular interest and value in light of the new rules of health distancing imposed by the COVID-19 emergency.

The project began with several workshops on the concept, design and construction sites for various cultural service devices – hosted in the three schools involved in the project: Comprensivo Pescara 1; Istituto Manthonè; Liceo Artistico MIBE. This was followed by the activities carried out within the university courses "Urban Planning 1" (Prof. Piero Rovigatti) and "Materials and Design of Building Elements", taught by professors Daniela Ladiana and Camilo Cifuentes (visiting professor, Universidad de La Salle), as part of the DdA undergraduate course in Architecture at the G. d'Annunzio University of Chieti and Pescara.

Figure 5: An indoor "Literary Cloud" created by children at the Ugo Foscolo School.

Figure 6: An outdoor "Literary Cloud" created by children at the Ugo Foscolo School.

This simultaneous and complementary nature of the activities carried out by different schools represented one of the programme's most important wagers. A wager partly won, thanks to the joint efforts of teachers and directors from different disciplinary and institutional backgrounds. A common trait lay in the initial suggestion, evoked in the project's title, "The Literary Cloud": an isolated and even autonomous space, located either inside or outside the participating schools. The "Cloud" is a place where children can find acceptance and shelter, read a book, watch audio–visual content or listen to music, and much more. It is also an antenna, and an external cell, of the mother Neighbourhood House library, to which the "Clouds" are connected. This connection is both material (the Library supplies the Cloud with books and other cultural content), and immaterial, because through its accessory devices (video, network screens) it acts as a vector for the initiatives – seminars, meetings, activities – that animate cultural life in the neighbourhood of which the Library is the "House". This suggestion took shape in different design solutions, anticipated by studies using models and experiences gathered from the research. During a first phase of the

workshop, high school students were also involved in a search for interesting case studies. Their work produced a participatory map, available at: https://www.google.com/maps/d/u/0/edit?mid=1IiDc5RhjzW01HITNmhEAmJr6PyPVBVyJ&ll=0.8300771966894942%2C0&z=2.

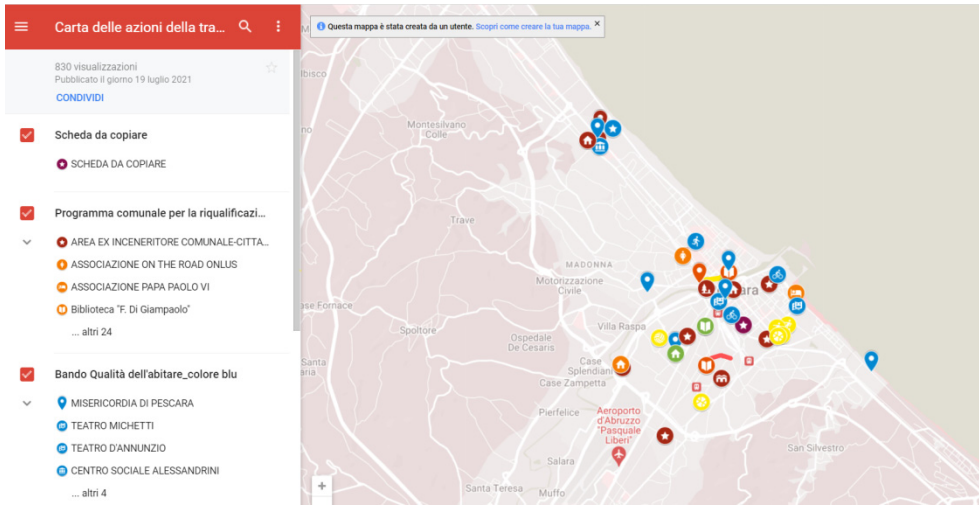


Figure 7: Participatory map of case studies of interest produced by high school students.

The Literary Cloud is, in short, the idea that the teachers, researchers, school administrators, children and young people involved in the project all tried to realise. Their work began with early concept and design workshops, initially remote, though with the hope that the evolution of the COVID-19 emergency would soon allow for a return to classroom activities, and the realisation of interventions whose *raison d'être* is precisely their collective nature, to be carried out in safety, within the education community, to which they are addressed. Some hypotheses remained on paper, at the concept level; others led to the creation of scale models, based on projects accompanied by initial feasibility studies; others finally led to the creation of actual prototypes, such as those created by the team led by the teachers of the "Comprensivo Pescara 1" course, in collaboration with secondary school students. Their work has already been put into use in their schools. The initial programme was further defined in the activities of subsequent projects, including one launched as part of the "This School is a Common Good" project, under the umbrella of the Ministry of Education's Summer 2020 School Plan, at the same school, and with the development of the project described below, developed by a team of 5th grade students directed by Daniela Ladiana and Camilo Cifuentes.

Architecture students were asked to model "small buildings", in the form of a pavilion, which could be used inside a school building to articulate its spaces and enrich its possible functions.

2.2 Didactic experimentation

The didactic experiment involving students in the study of Public Engagement in Pescara's peripheral contexts was conducted as part of the undergraduate Course in Architecture, in the

1st year courses "Materials and Design of Building Elements", "Urban Planning I", and subsequently in the 5th year undergraduate "Design and Construction" laboratory.

Students were asked to develop a concept for the "Literary Clouds", isolated and even autonomous spaces to be placed within existing schools, where children could read a book, listen to music, watch audio–visual content, etc. University students were previously introduced, through a cycle of seminars, to the implications of the relationship between architecture and pedagogy. Subsequent teaching and design experiments were carried out at different levels of complexity, influenced primarily by the use of graphics software. This activity aimed at the creation of 2D and 3D models through an approach and the simultaneous continuous verification and refinement of the buildability of the design concept through the digital production of real models at various stages and scales of this process.

During the first phase of work, the design exercises assigned to students of the "Urban Planning I" and "Materials and Design of Building Elements" courses were coordinated by their respective professors: the choice and analysis of the real contexts in which to insert the "Literary Clouds" were the theme of the "Urban Planning I" course, while the "Materials and Design of Building Elements" course focused on the technological and environmental aspects of the concept.

The most interesting proposals were selected from the work developed by first-year students. This evaluation was benchmarked against the objectives of the Public Engagement initiative. Their work was presented to fifth-year students as a working hypothesis to be critically developed in terms of function and buildability. The designs were studied by different groups based on different interpretations of the proposed theme. This phase of the teaching process involved not only stakeholders who brought their knowledge of the issues and aims at hand, but also companies interested in providing resources and technologies for the solution of socially relevant issues in their own local reality.

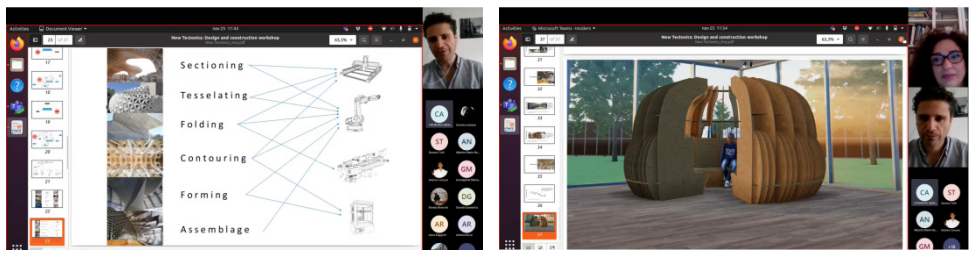


Figure 8: Parametric architecture seminar for the design of the "Literary Cloud" developed by professors Daniela Ladiana and Camilo Cifuentes (visiting) as part of the course in "Materials and Design of Building Elements".

The involvement of these companies proved particularly effective in bringing a concrete dimension not only to the ends pursued, but also to the means of pursuing them, thanks to the detailed description of available resources and processes for the realisation of the different proposals. Discussions with company technicians enriched the teaching by emphasising the importance during the design process of the specific constraints arising from the characteristics of the materials and fabrication processes made available.

The materials and building techniques adopted introduced students to technological innovation characterised by sustainability through the concept of "frugality", which combines environmental with social and economic issues [5].

Figure 9: 1:10 scale models of the “Literary Cloud” produced by students of the first year course “Materials and Design of Building Elements”.

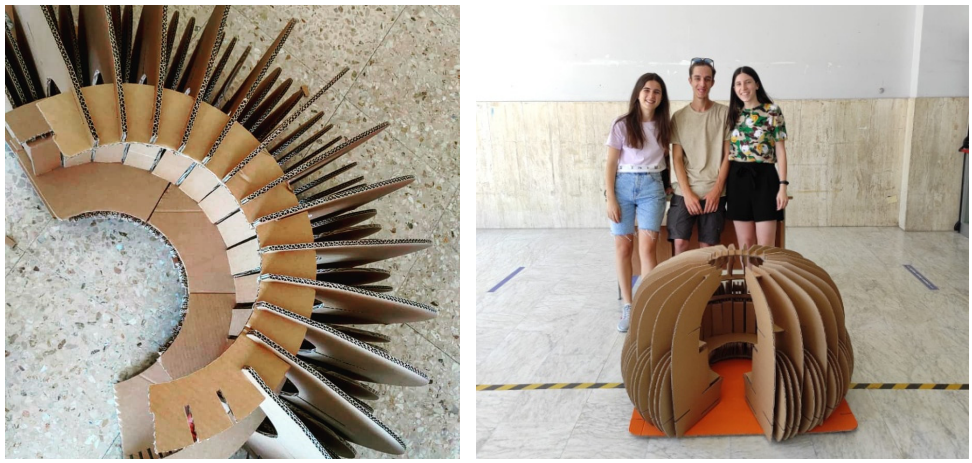
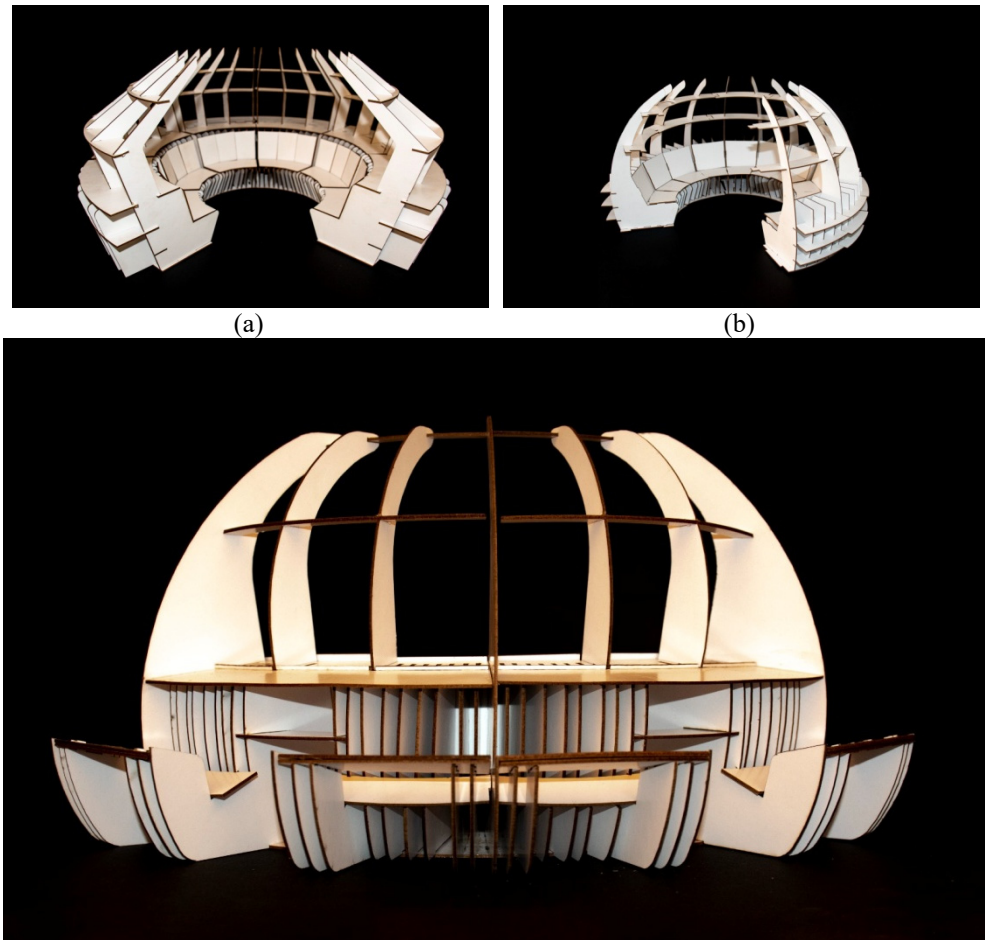


Figure 10: 1:3 scale models of the “Literary Cloud” produced by students of the first year course (Marta Mutignani, Elena Fusco, Alberto Narcisi).

This approach involves working toward technologies capable of effectively responding to the demand for goods and services for those with limited purchasing power, while respecting the environment. Designing for frugal innovation means implementing only the fundamental performance aspects, i.e. only those strictly necessary and important, excluding excessive engineering, to ensure simple modes of use and low maintenance.

Frugal innovation was, in fact, adopted as a possible field of study for the identification of an effective response to the need to provide new spaces to host cultural activities in schools, or in places where educating communities are active, in order to counter the emergency of educational poverty exacerbated in the urban peripheries of Italian cities by the recent pandemic. This was achieved by reducing the economic and environmental costs of products and processes through a reformulation of their complexity.

Pursuing low-cost innovation required students to carefully analyse and define the essential spatial, functional, structural and building aspects of the project. Designing the



(a) (b)

(c)

Figure 11: 1:10 scale models of the "Literary Cloud" produced by the fifth year "Design and Construction" undergraduate laboratory. (a) Students A. Ciccone, A. Gianfelice, F. Manocchio and A. Palermo; (b) Students M. Borghese, B. Bravetti; and (c) Students S. Monar, E. Sabato.

"Clouds" essentially translated into the task of conceiving low-cost, lightweight, easy to assemble and disassemble, recyclable and disposable low impact constructions [6].

The scientific-disciplinary contents of the courses were based on the notion that developing an architectural project is equivalent to establishing technological relationships that constantly recompose the project in relation to paths and information that emerge during the development of the model [7]. In fact, the prototype project is implemented as an active system for integrating and weaving together the various aspects of an architectural programme, the physical qualities and behaviour of materials, and the contextual, physical and social environment.

Figure 12: Rendering of the adopted solution initiated at prototyping with undergraduate students (S. Gatto, D. Giannotta, A. Luce, L. Onorato, F. Remigio, A. Rossi).

Digital design tools were considered fundamental tools for promoting the ability to develop and control language in relation to the complexities of the project. Digital technologies are thus integrated in design as part of a process that regulates the information and interactions among the elements involved in the definition of form and which also configures the relationships between design and construction [8]. The constant involvement in the courses of experts provided by local companies producing the materials used in the experiments proved fundamental: ICO for corrugated cardboard, ICC for honeycomb cardboard, Walter Tosto for the support of nesting and cutting process optimisation for the creation of the 1:1 scale prototype.

From a scientific and pedagogical point of view, the adoption of an "object-based learning process" in the design exercise applied to prototyping was certainly fundamental: an approach centred on the active role of the student who uses physical objects, in our case models, to trigger a deeper and more lasting learning experience [7].

According to this pedagogical model, adopted in the design workshop, the contact between student and model – progressively perfected through the teacher–student and student–class relationship – stimulates interest in deepening the technological, theoretical and instrumental knowledge necessary for the design and realisation of the object of study, enabling it to be applied, with creative ability, in other design situations [9].

The second characteristic aspect of this approach is that the teaching of technological design for prototyping models leads student toward a more "integrated" learning process, so to speak, that "integrates" knowledge of design, geometry, material and structural characteristics. In addition, there are also important aspects of the real context, such as the optimisation of production and the economic feasibility of the model. The third important element is that of bringing students closer to the evolution of supply/demand, towards widespread production practices and open-source design that will increasingly characterise social and economic reality in the near future.

Figure 13: Knowledge as a "common good": Presentation of the work developed by the students of Prof. Rovigatti's Urban Planning course at the library, neighbourhood house, "F. Di Giampaolo".

3 CONCLUSIONS

The realisation of the "Clouds" prototype was based on an experimental teaching methodology that integrated first year courses in different disciplines, with courses from the same disciplinary field but from different years. In the assignment and development of the themes, this approach to teaching saw courses within the framework of the PE activities of the Pescara Department of Architecture working with schools in the periphery, characterised by educational poverty and high dropout rates; finally, the phase of realisation involved local businesses.

Such approaches evidently led to a higher degree of involvement and acquisition of skills by students, thanks to the adoption of a design process characterised by greater, curiosity, resourcefulness and the ability to discuss and verify results. Great importance was focused on the possibilities offered by digital design and production, which allows design hypotheses to be quickly and effectively grafted onto reality. This allows for greater possibilities for self-control and self-correction, and permits direct verification of the buildability of hypotheses formulated. It was, in effect, a matter of supporting a design process in which the student carries out the "trial and error" process more independently, thanks to the facilitation of feedback between reality and digital model.

In this experience we can point to some partial but encouraging observations as initial results: the youngest students showed a greater perception and ability to represent space and equipment in relation to ergonomics and anthropometry; a greater understanding of the problems related to the realisation of joints and connections; a deeper acquisition of the importance of the characteristics of materials. Final year students, on the other hand, demonstrated a greater ability to govern the relationship between material, structure and form; a greater awareness of the relationship between form and the construction process also in its economic implications.

Important results were achieved on the level of relations and implications between the Department and the local context, thanks also to the organisation of communication and

dissemination activities tracking the progress of the work, such as public events and exhibitions in the places affected by the students' projects, used to share content with the communities involved.

Despite what was a demanding and articulated process, positive "clouds" are still on the horizon in the schools and urban commons of the Rancitelli-Villa del Fuoco and San Donato neighbourhoods in Pescara: "Literary Clouds", filled with good drops of a new and fresh rain of words, sounds, colours and images for the thirsty Pescara suburbs, which await new horizons of good sociality, serene community life, outside and beyond an emergency whose end we have all been waiting for.

ACKNOWLEDGEMENTS

We would like to thank all of the companies who donated their time and resources to the development of the prototypes: ICO for the use of corrugated cardboard; ICC for the use of honeycomb cardboard; Walter Tosto for nesting support; Gb Grafica for the optimisation of the 1:1 scale prototype cutting process. Thanks to graduate student Simona Tolli for her collaboration in documenting the prototype realisation process.

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