

# FOSTERING DESIGN EDUCATION IN NON-DESIGN STUDENTS: A CASE STUDY OF ACTIVE AND PROJECT-BASED LEARNING IN A SCHOOL-UNIVERSITY TRANSITION PROGRAM

F. Guarnieri, A.G. Manciaracina, G. Gerosa

*Politecnico di Milano (ITALY)*

## Abstract

With the recent COVID-19 pandemic, the European Union implemented a new economic model to intervene in some damaged sectors, particularly education, training, and employment support for youth. In this direction, Politecnico di Milano has launched an active program to encourage and guide students to transition to higher education. To help young students make a choice suited to their abilities and interests and cope with university dropouts in later years, Politecnico di Milano engages high school students in short courses to explore educational pathways, bridge knowledge gaps, and gain insights into future job sectors. These experimental courses aim to bring students closer to the didactics of the School of Design by conceptualising an exhibition space within the Liceo Artistico Boccioni in Milan to showcase the high school's 40-year history through student-produced work.

A group of educators, utilising a project-based approach, carried out a pedagogical experiment in which the design field was taught to young students not previously engaged in design activities. The students were challenged to design their own exhibition space, engage in research and creation, understand the roles of the project figures involved, and do prototyping activities while emphasising the reuse of materials. They were instructed in applying precise design tools for implementing rapid project concepts with an approach that underscores the importance of design-focused upcycling processes.

The paper seeks to show the structure, implementation, and outcomes of experimental workshops arranged to investigate students' preconceived notions of exhibition spaces and designing solutions, defined by a strong relationship with an active learning approach and the valorisation of technologies.

Keywords: design education, design orientation, design tools, project-based learning, exhibition design.

## 1 INTRODUCTION

During the COVID-19 pandemic, the European Union launched the Next Generation EU Program ([https://next-generation-eu.europa.eu/index\\_en](https://next-generation-eu.europa.eu/index_en)) [1]. This program aims to facilitate and expedite the economic recovery of European nations by focusing on ecological transition, digitalisation, training, and social inclusion [2]. As shown in the most recent OECD study, "Education at Glance 2022" [3], Italy has a lower proportion of individuals aged 25 to 64 with a tertiary level of education (such as a degree) compared to the average of OECD nations. Specifically, just 20% of Italians in this age group have attained a higher education, which is half of the average of 41% among OECD countries. Italy has sought to bolster education, training, and employment assistance for young people in this context through its National Recovery and Resilience Plan (PNRR). As part of this plan, universities and research institutes are working to better educational systems and foster digital skills.

Following these objectives, Politecnico di Milano has initiated the "Active Orientation in School-University Transition" initiative with the specific aim of mitigating the occurrence of university dropouts. The initiative seeks to reduce attrition by adopting proactive guidance from secondary to tertiary education. Its goal is to bridge the gap between the selection of a university and the successful completion of the chosen program. This initiative, influenced by socio-constructivist methodologies [4], encourages student engagement, improvement, and skill acquisition. The program is aimed at high school students invited to participate in short courses organised by university professors in collaboration with high school teachers [2]. The program aims to facilitate participants in comprehending various educational pathways, validating and strengthening their existing knowledge to bridge the gap with the requirements of their desired course of study. Additionally, the program aims to provide insights into different job sectors, employment opportunities, and an overview of potential sustainable and inclusive careers in the future (<https://www.polimi.it/orientamento-pnrr>).

The School of Design at Politecnico di Milano advocates a shift from the traditional passive learning approach to a more engaging and participatory learning experience, aiming to ease the transition from high school to university.

Active learning is a transformative approach to education that redefines the roles of both students and teachers. It may be described as an instructional model that engages students in practical activities and encourages them to reflect on their actions [5]. Active learning is commonly linked to several teaching methods rooted in social-constructivist principles. These methods urge educators to depart from conventional classroom instruction and embrace inquiry-based approaches [4]. These methodologies encompass problem-based learning, project-based learning, and authentic learning experiences.

The student takes on the central position in the educational experience and fosters collaborative behaviour with their peers. Meanwhile, the instructor is a facilitator, encouraging engagement by cultivating genuine student alliances [6].

Due to these qualities, active learning has been defined as a student-centred strategy in which teachers promote, assist, and guide the learning experience due to these specific features [7]. The School of Design presents an educational model built upon integrating theory and practice since its establishment. Its objective is to exemplify a diverse range of approaches. It aims to familiarise young students with its "epistemology of praxis" approach by providing courses that incorporate active learning methods [8], [9]. Embracing this view, a group of professors from the School implemented a project-based methodology to introduce the design field to adolescent students from a high school in Milan, Italy.

In this scenario, during the past academic year, the School of Design undertook an experimental project in Liceo Scientifico Einstein in Milan dealing with innovative learning spaces and introducing design concepts to non-design students [10] to foster creativity and awareness of the designer's role in modern society. Building on the previous experience, the course organised during the 2023/24 academic year is addressed to the Liceo Artistico Boccioni. It wants to explore the world of design in exhibition design. This experimentation embraced a project-based active learning approach [11], [12] to enhance collaboration and critical thinking skills among high school art students while bolstering their design-related competencies.

## 2 OBJECTIVES

In response to the "Active Orientation in High School-University Transition" project, the School of Design of the Politecnico di Milano has partnered with Liceo Artistico Boccioni in Milan.

Compared with the experience with Liceo Scientifico Einstein, where students were unfamiliar with the design discipline since it was not included in the education program, the course offered to Liceo Artistico Boccioni is aimed at students already familiar with design workshops and design courses.

The School of Design organised a course to lead students in designing an exhibition space to celebrate the high school's long history, its students, and their works: students must select and display physical and digital artefacts made during their studies.

For the students of Liceo Artistico Boccioni, this course represented a real opportunity to:

- Be introduced to the design of an exhibition space;
- Identify what professional figures are involved in an exhibition design project;
- Carry out a final installation within a selected space in the high school;
- Get closer to a project-based approach promoted by the School of Design.

For the School of Design, the course enabled students to receive educational guidance: the underlying theme of every interaction was to enhance students' understanding of the implications of studying design in a university setting. This was possible because the meetings were held primarily at the Campus of Design of the Politecnico di Milano, bringing students closer to the university reality.

The primary objective of the design experimentation was to bring the young students involved to form critical thinking about exhibition design by proposing project concepts that would tell their high school's 40-year history, creating a connection between past, present and future.

A further goal was to rediscover and rethink all those spaces of Liceo Artistico Boccioni that are not accessible by students but that help in telling the past story of the high school; for this reason, the course proposed the design activity in the former showers in the basement.

Before being a high school, Liceo Artistico Boccioni was an institute that provided education and housing for deaf children: the Royal National Institute of the deaf-mutes “Principi di Piemonte”. Built in 1933 and subject to several reconstructions, the spacious classical-style building housed three floors of classrooms, a kindergarten and dormitories. In the basement, the showers were used by patients of all ages, so they were specially designed to accommodate children and teenagers. The Liceo Artistico Boccioni was already established in Milan for some years when it moved to its new building in 1981. However, it continued to share some spaces with the Institute until three years later when, due to student protests, additional spaces were allocated to the school. As a result, the 3rd Liceo Artistico was created as an independent institution [13].

The activities organised by the research team and the place chosen to host the exhibition were driven by a project-based learning approach [11]. This instructional method focuses on student-centred learning and encourages social interactions to exchange knowledge and understanding to achieve specific goals. Due to the particular educational setting, the students explore genuine questions and challenges within real-life practices.

This approach aims to lead the student to:

- Construct a final product;
- Demonstrate the knowledge obtained through various educational tools, such as movies, photographs, sketches, reports, models, and other means [12].

The efficacy of PBL hinges upon the teacher's adeptness in orchestrating the activity and their capacity to inspire and steer students at every phase, providing them with assistance in their educational journey [14].

This paper recounts the pedagogical approach employed to introduce exhibition design to people without training. It uses a PBL method and focuses on its ability to foster students' creative capacity.

The course's overall aim was to make students reflect on an objective, concrete design solution for their exhibition space, engaging in research, creation, and prototyping activities while emphasising the reuse of materials. It becomes essential to convey to young students the challenges that the designer has to face in contemporary society: embracing the principles of the circular economy, as advocated by the European Union's Circular Economy Action Plan [15], involves giving new life to discarded materials, thereby extending their life span.

This approach underscores the importance of design-focused upcycling processes to encourage young designers to be more sensible with their design ethics [16], as the issue of environmental waste and their reuse and reinvention is highly topical. The upcycling approach gives more personality to the space as it involves manipulating and combining materials in different and creative ways to achieve a new product that reflects the requirements and needs of its new function and space. In addition to rethinking the life cycle of materials, new innovative processes in line with sustainability need to be explored, especially in response to the ephemeral and transient nature of an exhibition system, designed not only to last a short time but also for specific contexts and sites [17]. Therefore, adopting tools and strategies to materialise these values into replicable and scalable design solutions is essential, where recycling and reuse limit the waste produced, mainly by installation disposal. To best apply this approach in the design of the exhibit space, it is essential to design a temporary exhibit that:

- Took into account the life cycle of the materials, including their construction, use and disposal [18];
- Guaranteed new uses for the materials, ensuring a holistic approach to sustainability in the exhibit [19];
- Had the characteristics of simplicity, modularity and reproducibility to facilitate disassembly and thus did not require specialised tools and knowledge [18].

The forty students of the Liceo Artistico Boccioni were asked to develop creative solutions at minimal cost while involved in active and exploratory activities and fostering peer critique exchange [20] and critical thinking [21], [22] to:

- Understand the context of use;
- Identify space needs, potentials and limitations;
- Design one or more solutions;
- Evaluate the results against the context and initial conditions.

For each of these steps followed by students in the planning stages, the teaching team supplemented each lesson with investigative and generative tools, such as:

- Case study collection and analysis;
- Context analysis and collective brainstorming;
- Peer exchange and critique activities;
- Surveys and interviews;
- Scenarios and user journey.

By implementing this process in the courses, the research team wanted to introduce students to different learning and working methodologies, experiencing them through concrete project work.

### **3 METHODOLOGY**

Building on the previous experience involving the Liceo Scientifico Einstein in Milan, the course proposed during the 2023/24 academic year at the Liceo Artistico Boccioni included the participation of students in more active, exploratory and social procedures, bringing them closer to the design of an exhibit according to an upcycling approach. This experience allowed for a further deepening of the active orientation activity of the Politecnico di Milano. The course was organised to get students closer to the university, always encouraging interactions and activities that could lead to a continuous and mutual exchange of ideas and knowledge between educators and students. The course took place mainly at the Design Campus of the Politecnico di Milano. The research team decided to adopt specific tools, such as questionnaires conducted before and after the project, to discover the students' pre-course knowledge and to track the evolution of their perspectives in the design activities since surveys have been valuable tools to assess their effectiveness.

#### **3.1 Courses organisation**

Three Professors delivered the course from the School of Design of the Politecnico di Milano. It involved forty students enrolled in the third and fourth years of the Liceo Artistico Boccioni in Milan, divided into eight groups. The course started on 2nd February 2024 and lasted two months, during which the faculty and students met in the afternoons in the classrooms of Politecnico di Milano.

Compared with the previous experience, the course organised with Liceo Artistico Boccioni has some critical differences:

- While for Liceo Scientifico Einstein, all meetings were held at the high school premises; for Liceo Artistico Boccioni, only the first lesson was held at the school, while the remaining four were held at the Design Campus of Politecnico di Milano;
- While for Liceo Scientifico Einstein, 8 meetings were organised, each of 2 hours; for the current edition, 5 meetings every 2/3 weeks, each lasting 3 hours;
- For Liceo Artistico Boccioni were organised visits and activities at the university's laboratories to allow students to engage with staff, receive valuable suggestions for the realisation of the installation and get in touch with the university's tools and spaces;
- Working with students who are already familiar with the design discipline, with Liceo Artistico Boccioni, it was decided to keep the meetings at the Design Campus to generate moments of collective reviews, inter-group comparisons and exchange, thus leaving the design activity to the high school's teachers who followed the students at each stage of creation;
- An extra appointment was dedicated to the review of designed installation realised in the high school's spaces.

Even though the students were from two different classes, the course was organised to make it easier for them to meet and present the work done during the previous days to receive suggestions and comments from teachers and peers.

While most of the project's research, analysis, creation, and prototyping took place during school hours and students were supervised by their design teachers, the School of Design's active orientation course introduced students to various activities and levels of interaction. It showed a selection of case studies on the topic to generate an ongoing exchange and free discussion between teachers and students and

offer collective reviews to facilitate peer exchange, discussion, and constructive debate to help students develop critical thinking towards potential future scenarios.

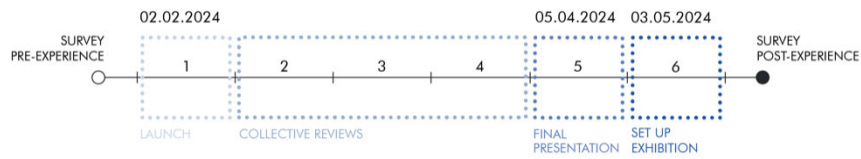


Figure 1. Representation of the course organisation.

### 3.2 Survey administration: a pre-design vision

To better understand students' level regarding the design discipline and the exhibition design, an online survey was constructed and sent to all the participants two weeks before the start of the course, with 20 responses out of 40 students. The goal of the survey was to investigate students' thoughts on the three main topics to be discussed during the following meetings:

- The personal view on design and the role of the designer;
- The meaning of exhibition design and what are the main characteristics of an exhibition space;
- Who are the professionals working on an exhibition project, and what do they do?

During this first discussion, the students expressed their views on design, describing this discipline as "a creative process capable of creating innovative and effective solutions, integrating aesthetics and functionality" or stating that "design responds to needs, proposes solutions or possibilities to improve the quality of life of human beings". On the other hand, the designer was described as a figure capable of working in a team and taking care of a project from the research, creation, prototyping, and communication stages.

*"Generally, the designer's role is to guide the creative process and solve problems through design".*

*"The designer is a mediator between client needs and people's expectations, helping to unify the world around us in a functional, aesthetically beautiful and meaningful way".*

*"The designer creates functional and aesthetic solutions for specific environments".*

From these first survey responses, it is possible to understand the level of knowledge the Liceo Boccioni students have regarding the discipline. Precisely for this reason, it quickly became evident how important it is to understand what kind of knowledge they have of the world of exhibition design, from the space to the tools used, from its communication to the professional figures working in the sector.

*"An exhibition space is an environment designed to present and display works of art in a visually meaningful way, creating an immersive experience for visitors".*

*"Within an exhibition project, there are various professional figures; for me, the main ones are Architect, for the structural and architectural aspects; Design, for the visual aspect of the installation; Curator, for selecting the works to display".*



Figure 2. Keywords used by students to describe the elements that characterise an exhibition space.

The student's perception of the exhibition space refers to a space designed exclusively for displaying works of art, photographs, and artefacts of any kind; in fact, the students do not think of the exhibition space as a place where interaction between the public and the work of art can take place. The temporary exhibition component was a key aspect to be explored during the course. Indeed, the challenge set to the students was to design a temporary exhibition that would combine the history of their high school with an innovative, modular and replicable exhibition system at different scales.

### 3.3 Coursed delivery

As previously mentioned, the 40 students participated in a total of 6 sessions, divided into:

- 1 group lesson to introduce students to the course topic (at Liceo Artistico Boccioni);
- 4 collective reviews (at Design Campus of Politecnico di Milano);
- 1 final meeting during which students set up their project (at Liceo Artistico Boccioni).

Between lectures, students had the opportunity to work on their projects in class, with their lead design professor guiding them through each stage of research and conception.

All meetings included revision sessions and other orientation activities within the university's teaching spaces, such as visits and lectures.

The first session, held at Liceo Artistico Boccioni, was organised by university professors as an introductory lecture, outlining what to design and where to achieve the objectives.

The exhibition's aim was explained to the students: a project that must be able to tell the 40-year history of their school, displaying the artefacts made by the students over the years and developing an exhibition system that reuses materials. Through the analysis of some case studies, the students were shown projects that take up contemporary challenges, i.e. designing with awareness of the product life cycle, thus creating practical, functional, and adaptable products. After the initial discussion, the professors guided the students through a site survey. The members of each group were given specific guidelines for surveying the assigned space, helping them to carry out quantitative research [22] through the study of natural light, the presence of artificial lighting, the type of covering and the colour of the surfaces.

The second session was organised by dividing the lecture into two moments: the first one was run by the Historical Archives of the Politecnico di Milano with a visit to the *Made in PoliMi* collection, located in the atrium of the Rector building on the Leonardo Campus, and a second moment was made of collective reviews. The lecture given by the Historical Archives was organised to introduce students to curating, making them understand the importance of having defined roles within a group to facilitate the work and the exhibition's success. For this very reason, students were asked to identify the role each group member would play, considering each person's aptitude, abilities and skills.

The third and fourth sessions (carried out as the fifth on Campus Bovisa, where the School of Design is based) alternated moments of collective reviews and tours of the laboratories dedicated to the design discipline. In particular, during the fourth session, the visit to Laboratorio Allestimenti (Lab Exhibit) of the Design Department of Politecnico di Milano was accompanied by a lecture to show students the set-up works they designed for various events. These were set-ups with similar characteristics to the course theme: systems created with recycled materials that are easy and quick to assemble and disassemble, focusing on their reuse for possible future reuses. During this meeting, the students could also discuss with the workshop staff, asking them about specific materials for their project.

The fifth course session was dedicated to the final project reviews, during which each group showed their work, illustrating the conceptual idea, plans and model realised. On this occasion, the university professors decided to organise peer reviews among the students and, for this reason, asked their peers to carry out the reviews.

To obtain positive results from this activity, the teachers explained the purpose and conduct of the activity, leading the students in questions, suggestions/criticisms and observations. As emerged from the research of Bean and Melzer, the peer review activity has three basic themes [23] that allow us to understand its potential:

- Guiding students with a series of specially designed points enables them to provide similar responses as teachers;
- Students value peer review and feel they benefit from it;
- Students learn as much from their peers' comments as from the teachers.

The goal of peer review is to lead students to reflect on their strengths and weaknesses critically and take stock of what they have learned and how it can be applied in the future [23].

Also, according to the research of Bean and Melzer, students who interface with this type of activity are more likely to improve their work than students who receive feedback only from the teacher.



Figure 3. Professors provide students with guidelines for peer review.

Each group was given 10 minutes to display their work, and another 10 minutes were instead devoted to comments from the students. The works exhibited by the groups were very different, dealing with various themes and proposing varied design solutions.

### 3.4 Survey administration: a post-design vision

At the end of the two-month program, students were asked to fill out the survey they were initially sent to investigate and understand how their perception of the design discipline had changed due to this experimental course. The survey was structured by asking them a few questions from the initial one plus a question about their experience at Politecnico di Milano to compare the responses obtained at the beginning and end of the program. Out of the total participants, 36 responded to the survey.

However, their responses indicated that when students engage in a site-specific design activity that emphasises the practical implementation of the designed space and requires them to analyse the proposed solution critically, it enhances their understanding of the course material.

Furthermore, the survey revealed that implementing a praxis-based approach in these settings and actively engaging high school students in university teaching environments fosters a heightened understanding of the university experience and, in this particular instance, the educational opportunities the School of Design provides.

## 4 RESULTS

After two months of work, all groups at Liceo Artistico Boccioni responded enthusiastically to the project theme and the scheduled activities. They presented their two months' work results during the final meeting.

In contrast to the course held at Liceo Scientifico Einstein, this year's experience at Liceo Artistico Boccioni enabled the research group to collect additional materials above only presentations. Specifically, the students created hand-drawn illustrations of the concepts, the catalogue of works to be exhibited within the designed space, more precise 3D visualisations, and 1:20 scale maquettes.

Furthermore, each group complied with the given limitations, which included:

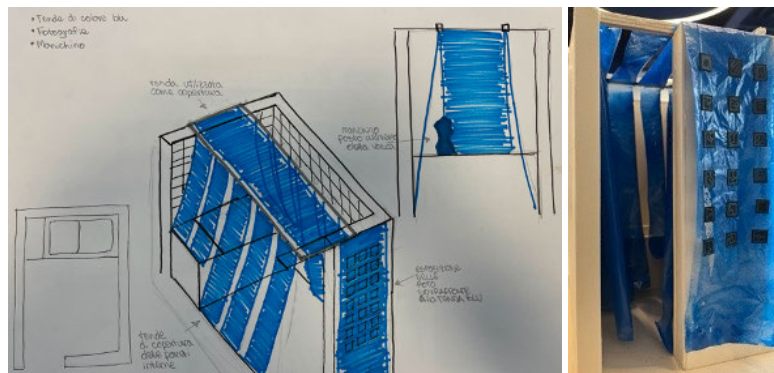
- Preserving the shower's architectural integrity and avoiding any substantial or irreversible variations;
- Utilising recovered materials or materials that can be readily repurposed in alternative settings such as wood, cardboard, fabric, etc.

Out of the 8 projects carried out, specific projects vary from others in terms of material selection and its application in the exhibit, the design creation that aligned with the course theme requirements, and the production of a model for the exhibit that can be easily replicated, adjusted, and expanded.

Among the several initiatives undertaken, one group presented "*Past - Present - Future*", a narrative that traces the school's history from 1933 to the present while raising inquiries about the future. The installation portrays the past by featuring a figure set in the shower, symbolising the youth who frequented the Istituto "Principi di Piemonte" and utilised the basement areas.

The present is conveyed through photographs documenting the school's activities and students. Lastly, the future is represented by curtains that obscure a space, appealing to us to unveil what lies beyond.

The students have chosen the colour blue to represent their findings, as it is commonly associated with identifying those who are deaf and hard of hearing. The concept materialises as a wooden framework positioned to provide a shelter for a shower. This framework also supports a collection of curtains comprising the exhibit, lowering to the ground.



Figures 4 and 5. Drawings of the installation's study and photograph of the maquette made

The group of the project "From Darkness to Light" made a distinct design decision: their installation explores the perception of Milan as a "grey" city where individuals blend into disorder and face difficulties in expressing their feelings. Students of Liceo Artistico Boccioni experience a vibrant and visually appealing environment where they can be themselves and develop self-awareness, particularly during their formative years. The project showcases a compilation of artworks from various locations of the school, which delve into the contrasting nature of shadow and light. A black curtain hides the entrance to the shower. Upon entering, visitors encounter a distinctive exhibition system: a sculpture that extends throughout the space. This sculpture comprises triangular, rectangular modules of equal size, interconnected to create a branching structure in all directions. This organic structure generates both horizontal and vertical surfaces that are utilised for exhibiting students' work. To facilitate the fitting of each triangle, the group developed a module made from discarded particleboard. They adapted it by incorporating a 5 cm deep cut on each side to enhance grip and stability.



Figure 6. Development of the module within the installation

Another group also collaborated on creating a sculpture within the area, utilising the technique of juxtaposition and assembly to form a single element: a cubic module available in three distinct sizes (10x10 cm, 30x30 cm, and 50x50 cm). The cardboard cubes are placed on a wooden board with multiple layers positioned above the tub. This arrangement forms a surface that supports the sculpture while it is being created and lowers it to occupy a portion of the floor. The arrangement of the cubes was orchestrated to represent a water source emanating from the bathtub, conveying the narrative of the exhibited items, ranging from drawings to models to miniature plaster and plasticine sculptures.



The installation, called "Growth Path," intends to showcase the personal growth and development of the learner. To document this progress, five students were selected, each representing a different field of study at the school. They were tasked with choosing one piece of work from their first year and one from the current academic year. Additionally, each student was interviewed to provide testimonials and photographs to accompany the installation.

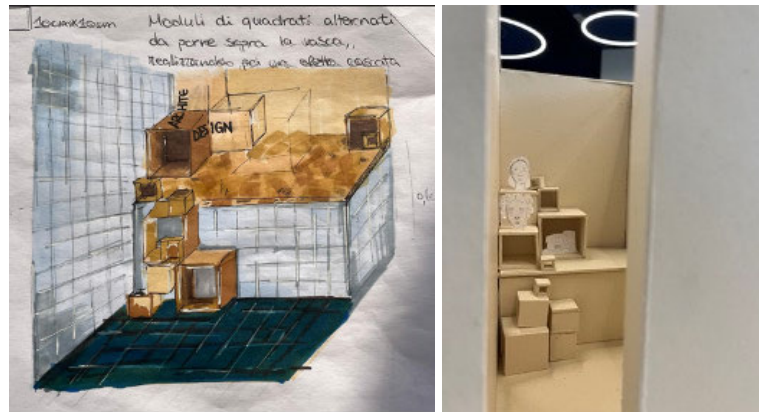


Figure 7. Design concept drawing and maquette

## 5 CONCLUSIONS

The School of Design and its research team seek to lead more young individuals towards making informed decisions about their future academic paths. This is achieved through engaging and practical educational experiences that involve active participation and laboratory-based learning. The ultimate goal is to guide these individuals through each project stage, ensuring their progress and success.

The students were involved in every aspect of their work, from identifying and developing a practical solution to an actual request to designing and constructing their full-scale idea. Their work ends with a public presentation through a group exhibition at the Liceo Artistico Boccioni in Milan.

Based on the positive feedback received from the students and the recently concluded experience, we can confidently state that the goals set with Liceo Scientifico Einstein have been accomplished. These goals include:

- Familiarising students with the teaching methods employed by the School of Design and the field of design as a whole;
- Assisting students in transitioning from high school to college;
- Enhancing the skills of individual students through active participation;
- Narrowing the gap between the skills students possess and those required by their chosen course of study.
- Exposing students to the project-based approach advocated by the School of Design;
- Proposing simple, agile and fast design requests to participants so that they can focus more on creating project relationships between the submitted content and the practice of its realisation;
- Carrying out a final installation within a selected space in the high school.

The course launched this academic year offered high school students the opportunity to fully experience the university's design environment, turning them into real design students, albeit for a limited duration. The experience also allowed the students to familiarise themselves with various facilities, such as classrooms and laboratories, which are usually inaccessible during open days and are only used by university students.

Future courses will enable the new students to work with an interdisciplinary methodology, using the latest tools and technologies to make communication and project realisation more efficient.

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