



## Learning by Doing: the Case Study of the Advanced Construction Management and Economics (ACME) Seminars

Enrico S. Mazzucchelli<sup>1</sup>, Mario C. Dejaco<sup>1</sup>, Gabriele Masera<sup>1</sup>, Angelo Lucchini<sup>1</sup>, Giacomo Scrinzi<sup>1</sup>, Verena Kaiser<sup>2</sup>, Daniel Heck<sup>2</sup>, Cornelia Ninaus<sup>2</sup>, Valentina Krivitsch<sup>2</sup>, Detlef Heck<sup>2</sup>

Politecnico di Milano, Department of Architecture Built Environment and Construction Engineering, Italy<sup>1</sup>

Technische Universität Graz, Institute of Construction Management and Economics, Austria<sup>2</sup>

### Abstract

*Since 2016, the ACME (Advanced Construction Management and Economics) seminars have been an international knowledge exchange course between Politecnico di Milano and the Technical University of Graz related to the “Agreement on strategic partnership between Politecnico di Milano and Graz University of Technology”. The seminars, that are characterized by students with different cultural backgrounds and coming from different engineering master’s courses, aim to familiarize them with all the fields of Building Design, Construction Management and Building Economics within a topic that is specified every year. The main aim of the seminars is to provide students with advanced knowledge of international engineering duties with a special focus on Austrian and Italian construction principles. In this regard, the theoretical lectures are combined with a workshop and building site visits. During the workshop activities, students work in small teams on the assigned topics. To that end, in the first week they employ a variety of qualitative research methods, such as site visits and data collection, sketching, drawing and writing to develop advanced 2D and 3D design concepts. The second week is characterized by the fact that the working groups exchange among themselves the projects that have been developed during the first week of the workshop. The goal is to lead each working group to analyse and understand a project developed by others, which may have strengths and weaknesses. This is a challenge for the groups, which leads them to question why some choices have been made and to find solutions for the optimization of projects. The site visits are intended to convey the theoretical input in a practical way. The balance between the theoretical part, workshop activities, building site visits and social events proved to be extremely important for creating close-knit and productive working groups in a very short time and to introduce students to a cultural reality different from their own. Moreover, the mix of skills and competencies of the working group members was essential to create students’ teams rich in cultural education, in order to reach the interdisciplinary goal of the programme.*

**Keywords:** *interdisciplinary education, teamwork, learning by doing, engagement, social inclusion*

### 1. Introduction

In 2016, the “Agreement on strategic partnership between Politecnico di Milano and Graz University of Technology” led to an intense collaboration between the two universities. Since then, the ACME (Advanced Construction Management and Economics) seminars have been a successful international knowledge exchange course that involved more than 150 students (57% male, 43% female) and 30 professors and assistants. The seminars aim to familiarize students with all fields of Building Design, Construction Management and Building Economics within a specific topic that changes every year. In the first five editions the topics were: “Construction Management” (2016), “Advanced Façades” (2017), “Prefabricated Building Technologies” (2018), “Design for Maintainability” (2019) and “Design of self-sufficient prefabricated modular units” (2020). This last edition had to be postponed due to the Covid-19 pandemic and, given the persistence of the situation, a special online edition was held in March 2021.

The ACME seminars are characterized by students with different cultural backgrounds, coming from various engineering master’s courses (civil, building, architectural and management of the built environment). The aim of the programme is to create students’ teams rich in cultural education, mixing skills and competencies, and to promote social inclusion among them. In this regard, interdisciplinarity is not only the relation and the interaction of separate branches of knowledge, but the integration of them as a whole [1]. Moreover, according to Rae & Carswell [2], a learning-by-doing programme enhances the development of students’ skills. The balance between the theoretical part, the practical



one and the building site visits is very important because it allows students to work on a real case study, developing their ideas, and to have real contact with the construction sector at the same time. This considering all phases of the building process, from design to use and maintenance, evaluating architectural and technical solutions also in terms of life cycle costs.

## 2. A “learning by doing” approach

The ACME seminars take place over two weeks, one at Politecnico di Milano and one at TU Graz, with the aim of giving students free time to socialize with each other and carry out extra-academic activities during part of the weekend. The seminars involve 32 selected students every year, divided in eight working groups (Fig. 1) consisting of two students from Politecnico di Milano and two from TU Graz.



Fig. 1. Working groups activities.

Participating students (attending the last two years of a MSc course) are selected through an open call procedure based on curriculum vitae, earned credits, weighted average of marks (regularly registered by the deadline of the call) and motivation letter. As mentioned above, the working groups are formed in order to have students with different backgrounds, characterized by a mix of skills and competencies. This has the aim of ensuring that each student can give a personal contribution to the development of the project, but at the same time can learn how to face a problem from new points of view. In this way, students can learn and exchange knowledge with each other, under the guidance of the workshop supervisors.

### 2.1 Weeks structure and contents

The ACME seminars take place over two weeks, one in Milan and one in Graz. Each week is structured as follow:

- Lectures (1 day)
- Site visits (1 day, 2 visits)
- Workshop (3 days)
- Social events
- Working groups presentations (midterm and final)

The first week lectures, both from industry and academia, aim to guide the students towards the development of the workshop design theme from the concept development and technological solutions point of view. In this regard, each working group faces a theme with the aim of developing a preliminary design related to the assigned topic. In the second week, the lectures aim to guide the students towards the development of the construction management process. Therefore, the main topics are construction techniques, cost and time calculation, building method comparison, project management, work preparation and contractual topics.

The lectures are combined with building and production site visits (Fig. 2). The aim of the site visits is to make students aware of the importance that design choices can have on the construction of a building, both from the point of view of construction process and site management.

During the workshop activities, students work in small teams on the assigned topics. To that end, in the first week they employ a variety of qualitative research methods, such as site visits and data collection, sketching, drawing and writing to develop advanced 2D and 3D design concepts. Each group is free to use the tools that are considered most appropriate, enhancing students' engagement

to achieve the workshop goal. Therefore, the supervision activity is connected to a critical analysis of the problems that the students gradually encounter in the development of the design concept and supervisors seek to engage students in more hands-on, creative modes of learning.



Fig. 2. Building site visits.

Cope & Watts [3] explained that individuals learn from experiences and failures. In this regard, the second week is characterized by the fact that the working groups exchange among themselves the projects that have been developed during the first week of the workshop. The goal is to lead each working group to analyse and understand a project developed by others, which may have strengths and weaknesses. This is a challenge for the groups [4], which leads them to question why some choices have been made and to find solutions for the optimization of projects.

The midterm and final presentations, with a plenary discussion of the proposed solutions from a technical and economic point of view, aim to accustom students to present the results of their work in a synthetic and incisive way and to be able to face a discussion with a group of international experts. All assessments and feedback are completed during the two weeks programme, that ends with the participation certificate, valid for 3.0 ECTS - European Credit Transfer System (Fig. 3).



Fig. 3. Participation certificate ceremony (on the left) and group photo at the end of the seminar (on the right).

## 2.2 Observations on teaching experiences

The aim of the seminars is to teach specific knowledge in construction designs, building technologies, construction management, and project administration, in Austria and Italy. The lectures and supervisors, in combination with production and construction site visits, provide further understanding in the presented research areas. The ACME editions have shown a sense of belonging and collegiality that was deemed important to the staff that participated, and to all the students as well. In particular, the choice was to combine the didactic aspects also with activities able to introduce students to a cultural reality different from their own (Fig. 4), as well as, if possible, participation in extra-academic moments able to create a sharing of interests and a strong team spirit.



Fig.4. Workshop in a traditional vineyard (on the left) and free time activities (on the right).

The excellent and creative results of the students are related to some aspects, which have been highlighted in all the editions carried out so far. In particular, the main ones are:

- free and creative atmosphere of the activities
- development of the ability to quickly find answers to a problem
- mix of skills and competencies of the working group members
- formation of creative, inclusive and propositional working groups
- ability to discuss and support design “ideas”
- mix of cultural background and close relationship among students and supervisors
- international relations that persist beyond the seminar
- mix of lectures, site visits, workshop activities and social events
- mix of lectures by industry and academia
- close correlation with industry and construction world.

Finally, for some participating students, this international exchange project was the starting point to develop joint master theses between Politecnico di Milano and TU Graz.

### 2.3 Future scenarios

Because of the Covid-19 pandemic, the fifth edition had to be postponed and, given the persistence of the situation, a special online edition of the ACME seminars was held in March 2021, in order to keep the programme active. The 2021 edition consisted of webinars and a workshop in virtual classrooms (Fig. 05). Despite the difficulties of the case, all the students who took part in the activities demonstrated maximum participation and involvement. In fact, they did not just collaborate within the working groups, but all actively participated in the general coordination phases. This was possible thanks to the considerable degree of familiarization achieved with digital tools for communication and production of contents, skills that will be extremely valuable for their professional life also in the near future. In any case, the hope is to return to the traditional programme in the 2021-22 academic year, while enhancing the potential of the digital communication tools available for teaching purposes.

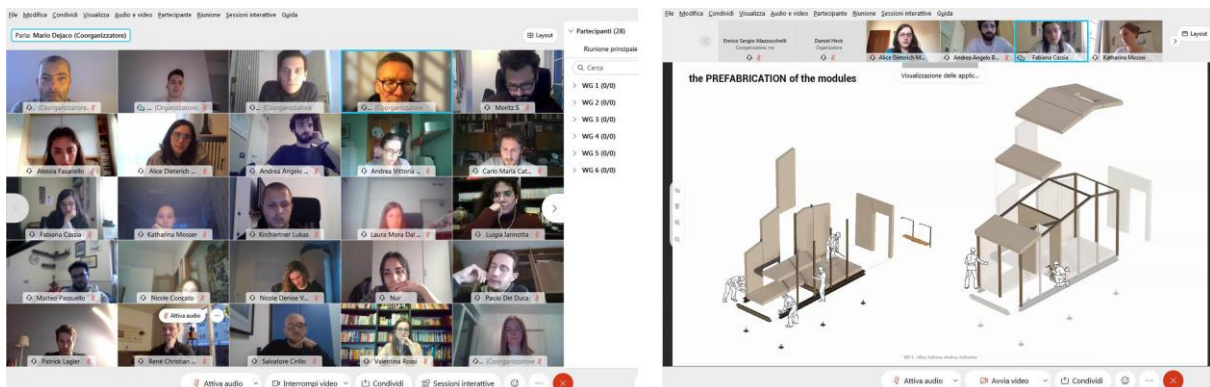


Fig.5. The ACME 2021 edition was held online using a platform with virtual classrooms.

### 3. Conclusions

In this paper, the most innovative aspects and experiences of the first five editions of the ACME (Advanced Construction Management and Economics) seminars have been presented and discussed.

The balance between theoretical part, workshop activities, building site visits and social events proved to be extremely important and effective for creating close-knit and productive working groups in a very short time, enhancing students' engagement. Moreover, the mix of skills and competencies of the working group members was essential to create students' teams rich in cultural education, in order to reach the interdisciplinarity goal of the programme, and to facilitate social inclusion as well.

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