

AN INCLUSIVE APPROACH TO INSPIRE CREATIVITY AND TEAM BUILDING THROUGH MODULAR ARCHITECTURE DRAWING

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Abstract

Integrating pedagogical innovations and inclusive approaches in university education represents a meaningful strategy to foster active and cooperative learning. Developing transversal skills such as collaboration and critical problem-solving is essential for the technical professions, such as engineers and architects, who face the increasingly complex problems of this millennium. This article describes a team-building experience as part of a first-year course in Building Drawing at Politecnico di Torino, aiming to enhance transversal skills and foster interaction between students from heterogeneous backgrounds. The experiential activity proposes a creative challenge in the field of modular architecture by using the 3D-printed basic element proposed by the architect Walter Gropius. The analysis of the results, conducted using questionnaires and qualitative observations, showed improved relational skills and strengthened student motivation. This experience shows how innovative teaching methodologies can contribute to academic success and prepare students to manage group dynamics in the professional context of building engineering.

Keywords: *Creative design experience, 3D printing, active learning, student engagement, higher education.*

1. Introduction

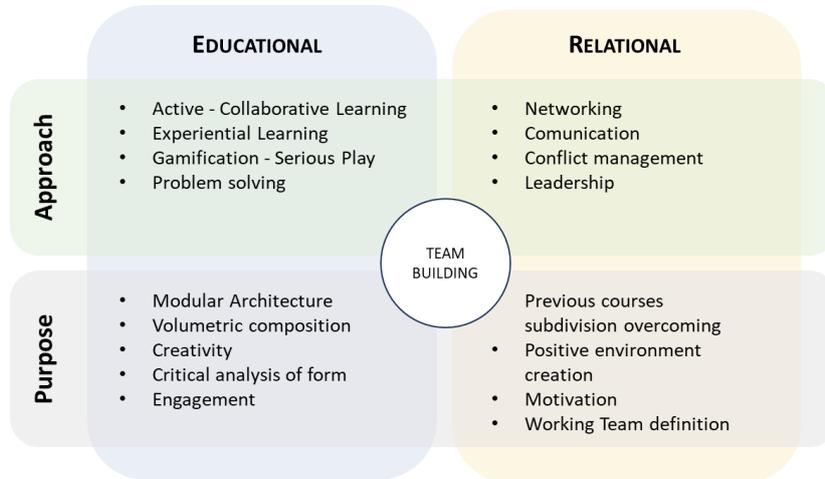
In recent years, team-building activities have emerged as effective tools for improving group dynamics and transversal skills in educational contexts, including university programs. In the field of building engineering, where multidisciplinary collaboration is a fundamental requirement for professional practice, the ability to work in teams is as crucial as technical expertise. However, traditional university courses tend to favour an individualistic approach to learning, overlooking the potential of cooperative methodologies in enhancing both student engagement and their preparation for the workforce. The scientific literature highlights that integrating team-building experiences into higher education can improve academic performance, foster a sense of belonging to the group, and enhance communication skills (Oakley et al., 2004). Recent studies show that approaches such as cooperative learning (Johnson & Johnson, 2017) and problem-based learning promote active learning and collaborative problem-solving for complex issues, thereby improving teamwork management skills. In particular, experiences in the engineering field have demonstrated that practical exercises and project challenges based on collaboration increase student motivation and engagement. Within this context, the present study describes a team-building activity designed for first-year Building Engineering students to develop transversal skills and promote a more cooperative learning process.

2. Methods

The team-building approach was experienced in the Building Drawing course at Politecnico di Torino, which lays the methodological foundations of Drawing as a communication language for engineers. As the first core course of the Building Engineering Bachelor's program, it brings together students who were previously distributed according to different criteria. Concerning this point, the objective of the experiential activity is to establish a collaborative environment and foster students' mutual acquaintance. These aspects are considered essential both for the course, which involves practical work in groups and for establishing effective interpersonal relationships that are fruitful for subsequent teaching. Sixty-five students from diverse educational backgrounds, including high schools, technical institutes, and surveyor schools, attended the experience.

The participatory activity proposes a creative challenge in the field of modular architecture and involves the definition of volumetric forms using the basic modules proposed by the architect Walter Gropius (Seelow, 2018). It has been designed with the dual objective of strengthening the educational experience and developing relational skills, as summarized in Figure 1.

Figure 1. Methodological approach.



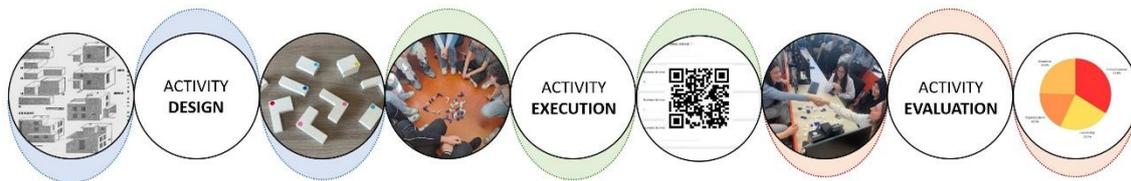
From a pedagogical perspective, adopting active approaches within the course (Ugliotti et al., 2023) is investigated to directly involve students in the educational process, stimulating their participation, reflection, and collaboration. Various techniques such as collaborative and experiential learning, gamification and serious play, and problem solving have been integrated into the experience to establish a synergy between theory and practice in order to facilitate the simultaneous development of disciplinary and transversal soft skills.

Engaging in active learning experiences compels students to confront and solve complex problems in collaborative contexts, thereby stimulating critical thinking, and adaptability. In this case, the activity was also able to foster the critical analysis of form, creativity, volumetric composition, and the use of modular architecture, prompting a deep reflection on expressive and constructive methodologies.

This type of learning impacts on the relational dimension of the students, stimulating skills of communication and networking and bringing out the predisposition to leadership and the need for conflict management. Creating a positive environment, and cultivating shared motivation contribute to forming cohesive and functional workgroups thereby rendering the team building experience a central and transversal component of the educational journey that integrates pedagogical goals with relational needs.

The activity involved three main phases: an initial design phase, a practical execution phase, and a subsequent evaluation phase (Figure 2).

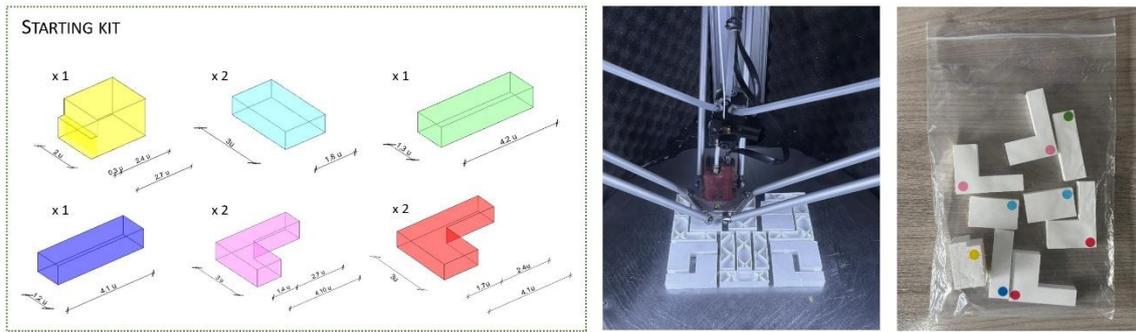
Figure 2. Activity phases.



2.1. Design of the activity

The preparatory phase of the activity entailed the digitalization of Walter Gropius’s 1922 “Baukasten im Großen” modular forms, which were modeled in 3D using Autodesk Revit software. A basic kit consisting of 9 modules was then defined and 40 identical kits were printed via a 3D printer. A simulation conducted with a small group of individuals allowed for the optimal organization of timing, scheduling and dynamics of the activity, identifying its strengths and proactively addressing its weaknesses.

Figure 3. Design phase.

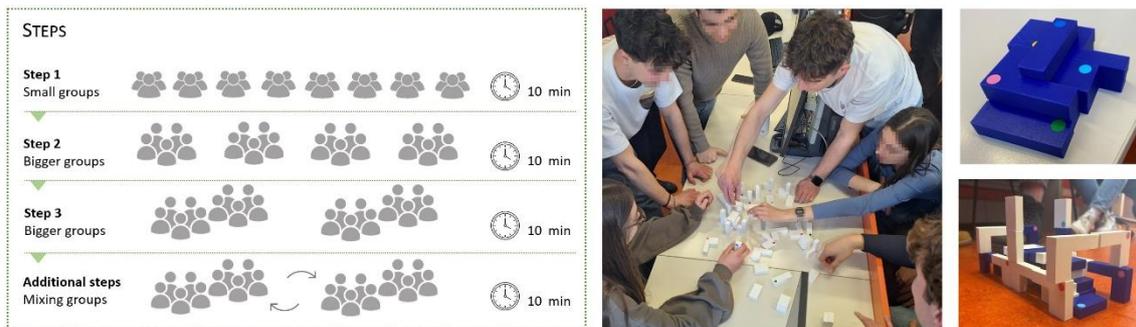


2.2. Execution of the activity

The team-building activity was structured into multiple phases. Initially, the students were divided into groups of two or three individuals based on their physical proximity to each other. Each group was provided with a starter kit and given specific instructions to assemble the modules into free compositions. To ensure a comprehensive record of the activity, each composition created was meticulously documented via the completion of a form specifying the students' names, the number and type of pieces used, the name given to the composition, and the attachment of a photograph. In the subsequent stage of the experiment, the small groups were joined two by two, thereby providing the students with the opportunity to construct using twice the number of modules. The groups were then further reunited without utilizing the logic of proximity, with the aim of fostering new interactions and increasing the number of available pieces. In the following phases, the groups were reorganized without increasing the number of participants, with the sole objective of facilitating interactions among as many individuals as possible.

Each phase lasted 10 minutes, in every phase each composition was documented using the form.

Figure 4. Activity execution.



2.3. Evaluation of the activity

During the activity, the teacher and collaborators paid special attention to qualitative observations of the dynamics among the students and the effectiveness of the planned task. Moreover, a questionnaire was administered to the students at the end of the last session to gather impressions of the teaching approach used and understand the level of engagement achieved.

3. Discussion

The team-building experience revealed several relational dynamics with important pedagogical and social implications. During the activity, the teacher and her collaborators observed that, through a spontaneous presentation phase (Figure 5. a), participants overcame interpersonal barriers, fostering a climate of openness and reciprocity.

From the first phase, devoted to small group formation, different approaches to problem solving emerged. Most participants adopted active collaboration (Figure 5. b), while in some cases a more individualistic approach was observed (Figure 5. c), in which each member focused independently on his or her own construction, emphasizing personal operational styles. In later stages, and thus with larger groups, the relational approach took on even more diverse forms. Some groups adopted parallel methods that facilitated a synergistic and equitable distribution of tasks (Figure 5. d), while others experimented

with sequential strategies (Figure 5. e) in which one segment of the group devoted itself to constructing the form and another to prototyping the composition.

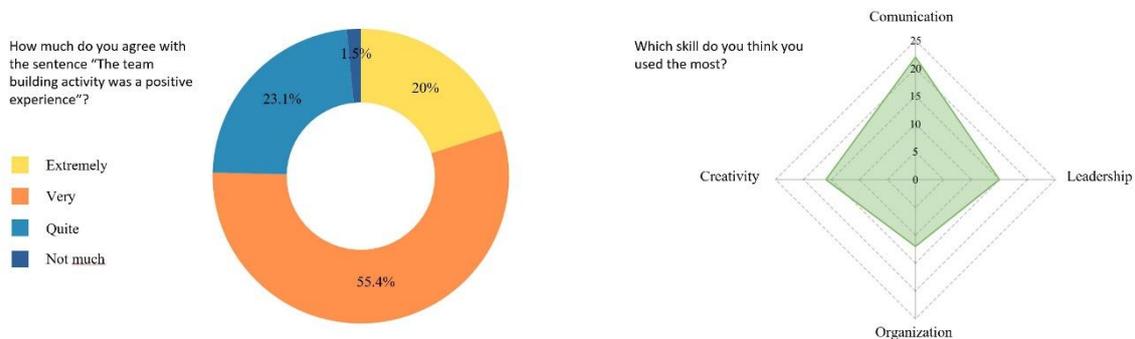
The latter dynamic is symptomatic of a spontaneous predisposition to effective coordination. Just in a few isolated cases, a lack of engagement by some participants was observed, highlighting the need to implement motivational and inclusive strategies, as well as to create an environment more conducive to collaborative activities, in order to encourage active participation and the development of optimal group dynamics.

Figure 5. Main relational dynamics observed.



The post-activity questionnaire highlighted additional experiential and relational dynamics. Over 75% of participants rated the experience as extremely or very positive. In addition, communication and creativity emerged as the most frequently utilized soft skills, proving to be essential for effective teamwork and problem-solving (Figure 6).

Figure 6. Valuation form results.



On the whole, these operational strategies contributed significantly to the development of key relational competencies and soft skills, including communication, networking, conflict management, and leadership. Such skills are indispensable for fostering cohesive and efficient teams in educational contexts, while simultaneously providing valuable preparation for the future Building Engineer.

4. Conclusions

This study has documented and analyzed, from a pedagogical perspective, a team-building activity aimed at enhancing transversal skills and fostering interaction among students from diverse backgrounds. The creative challenge, set in the context of modular architecture, involved the use of building modules inspired by Gropius' designs, modeled and 3D printed, offering participants the opportunity to reinterpret architectural space in their own personal way. In addition, it allowed them to investigate the compositional, graphic, and spatial principles that serve as its theoretical and practical underpinnings.

This approach fostered significant social interaction, stimulating empathy and the ability to critically tackle complex design challenges through dialogue and cooperation. The results highlight a marked improvement in relational and collaborative skills, along with a notable enhancement of creativity made tangible through the use of 3D printing. Furthermore, it is evident that the instructor's role has undergone a progressive transformation, from that of a mere transmitter of knowledge to a designer of comprehensive learning experiences that effectively maximize active student engagement.

Overall, this pedagogical model, replicable in various educational settings, significantly contributes to the discourse on educational innovation, demonstrating how advanced technological tools and interdisciplinary approaches can develop academic and relational competencies on solid, critical, and collaborative foundations, break the monotony of passive listening, and promote widespread, conscious participation.

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