Role of teamwork formulas in educating Bachelor of Science graduates in architecture

Agnieszka Matusik

Cracow University of Technology
Kraków, Poland

ABSTRACT: Educating students in urban planning and architecture is complex and extensive. Professional work requires graduates to possess broad skills in analysing needs and formulating answers to the problems of contemporary cities. It is necessary to introduce into teaching various forms of gaining knowledge and the skills to apply it. A skill required for future professional work is the ability to work as part of a team. Two formulas, 1 and 2, for operating within a collective are described in this article. Formula 1 is based on performing design tasks in teams within a regular module as taught in the Faculty of Architecture at Cracow University of Technology (FA-CUT), Kraków, Poland. Formula 2 involves participation in professional urban and architectural design competitions by teams composed of researchers and students. The author opines that combining both formulas can provide the greatest potential for gaining and testing knowledge that forms the basis for future engagement in real-world design tasks.

INTRODUCTION

The contemporary development of cities and performing interventions in their actual space is becoming an increasingly greater challenge in educating future architects, e.g. the graduates of the degree, Bachelor of Science in Architecture. The complexity of urban spaces based on ever-progressing globalisation and climatic, demographic economic and socio-cultural changes requires future architects to be equipped with a diverse set of skills that can enable them to understand and act within the contemporary city.

Contemporaneity demands that education flexibly reacts to it. This is the reason why supporting the regular teaching process with additional forms that enable the introduction of a much more diverse educational offering can be highly favourable [1][2]. The interdisciplinarity of the subject matter of architecture and urban design assumes the necessity to operate within diverse design teams. These comprehensive skillsets should be evident already during the first tier in educating future architects.

An objective of this article was to present two formulas of teamwork (formula 1 and formula 2). These are incorporated into the process of teaching future architects: the students enrolled in the degree for Bachelor of Science in Architecture in the Faculty of Architecture at Cracow University of Technology (FA-CUT), Kraków, Poland. The first formula, which is considered *basic*, is developed as a part of a regular design module during the first tier of study.

The second formula is a competition addressed to teams composed of research and teaching staff and first-tier students. It is introduced selectively, as a part of either interdisciplinary and inter-university co-operation or various ministerial projects. Both formulas were tested on one student who took part in both forms of teaching during their Bachelor's course.

TEACHING METHODS: TEAMWORK FORMULAS

The work of an architect is tied to teamwork, and hence teamwork must be introduced during the Bachelor's course. Its significance, expanded to include competitions, has been highlighted by educators [3][4]. At the same time, the increasingly complex requirements placed before young architects can be considered to demonstrate and highlight the role played by interdisciplinarity in the design process [5]. It is for this reason that it is essential to enable future architects to familiarise themselves with forms of work that engage representatives of a diverse range of disciplines already during their university education.

The objective of the article was to present the outcomes of introducing a formula of teamwork into the teaching process of the future Bachelor of Science in Architecture degree. With the method, the assumption is a combination of a regular design module taught over the course of a semester with additional design activities that extend beyond standard term

assignments. The author analysed the effects of the student works performed under the conditions of two mutually supplementing teamwork formulas.

The first formula (formula 1), applied in regular design modules, operates with varied levels of engagement in teamwork across the entire term assignment. The second formula (formula 2), which is elective, operates with a stable level of team members, while also intensively diversifying academic (student/researcher and teaching staff member) and professional member level.

CASE STUDIES. FORMULA 1: TERM ASSIGNMENT

The introduction of teamwork formulas becomes key with the increase in the difficulty and complexity of design problems proposed in the process of teaching the Bachelor of Science in Architecture degree. Urban design, because of its specificity, has become a suitable field for testing teamwork formulas; it is the well-suited mechanism for such activities when undertaken in an individual's design future.

Here, it is critical to develop skills related to an appropriate scope of knowledge necessary to co-operate both within a mono-disciplinary team and in a multidisciplinary team. Therefore, it becomes essential to develop the ability to understand the complexity of urban design decisions, which are highly dependent on their interdisciplinary and multi-subject character.

Formula 1 was tested in the urban design module taught by the Chair of Urban Composition (module supervisor: Professor Jacek Gyurkovich) during the sixth semester of the Bachelor's course. While the method was being implemented, the focus was on having the term assignment dominated by the teamwork formula. The supervision structure of the assignment was by division into three levels (see Table 1), with the first two assuming collective work. There was also individual work, which facilitated the verification of each team member's contribution.

Table 1: Teamwork in the term assignment.

Level	Analytical phase	Design phase	
		1:2000, 1: 1000 scale	1:500 scale
Level I (multi-person team)	Graphical and written assignment investigating the project site.		
Level II (two-person team)		Design and conceptual proposal for an urban layout.	
Level III (individual work)			Individual work on a fragment of the site while implementing jointly formulated assumptions.

The objective of this formula is to transfer the ability to work in a group (with a varying number of members depending on project phase), and then to introduce individual solutions that are compatible with jointly formulated assumptions.

Level I

The project featured a conceptual urban design proposal with a functional programme for areas around the Bagry water reservoir in Kraków, Poland. During level I, the students, working in ten-person teams, were tasked with performing an urban analysis to study:

- Spatio-structural and typological layers.
- Functional layers.
- Circulatory layers.
- Societal and cultural layers.
- Layers related to the ecosystem and natural assets and values.
- The identification of the urban structure and their continuity and accessibility.

The analytical phase culminated in conclusions that were publicly presented and subjected to general discussion. These conclusions form a basis for smaller teams to create a diverse range of designs.

Level II

Under level II the conceptual urban design proposal is developed. Working in two-person teams, students formulate guidelines and then design an urban layout (Figure 1). The key difficulty is making spatio-functional design decisions as a group and presenting them in a legible manner.

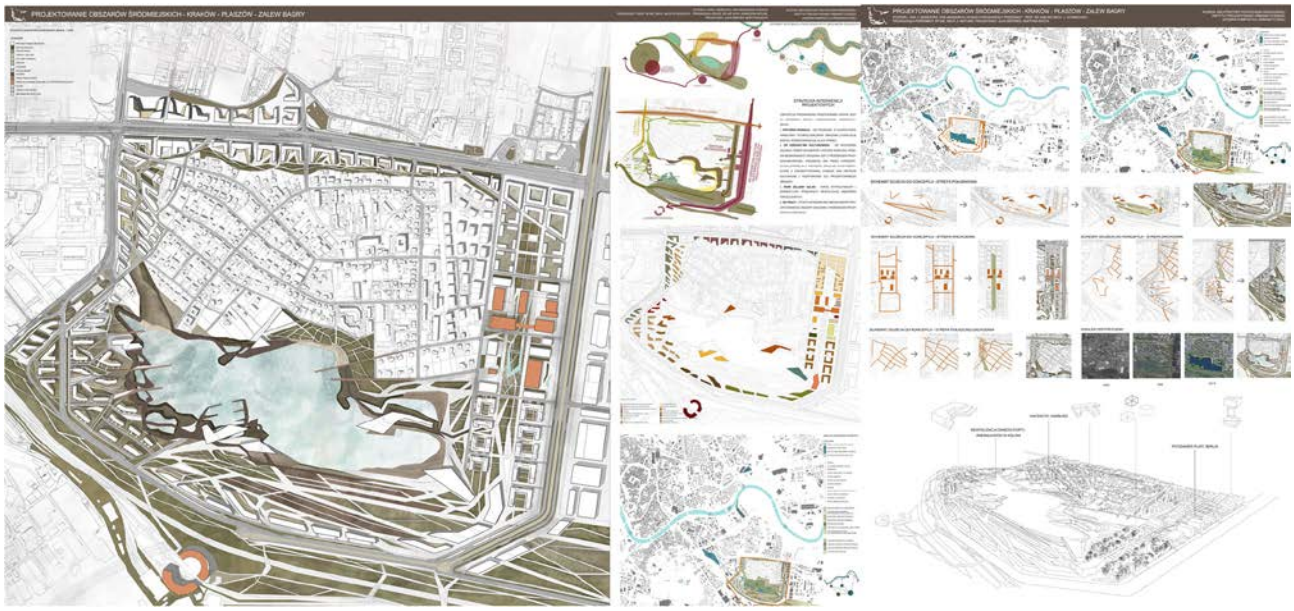

Figure 1: Fragment of a level II design assignment, involving two-person teamwork (Bagry area development plan, module supervisor: J. Gyurkovich; group tutor: A. Matusik; students: J. Sierpień and M. Socha).

Level III

Level III is an individual assignment. Students determine the functioning of a public space as a fragment of the larger layout concordant with the joint development guidelines (Figure 2). This individual phase is necessary to verify how a student has mastered the necessary skills and knowledge during previous design assignment levels.

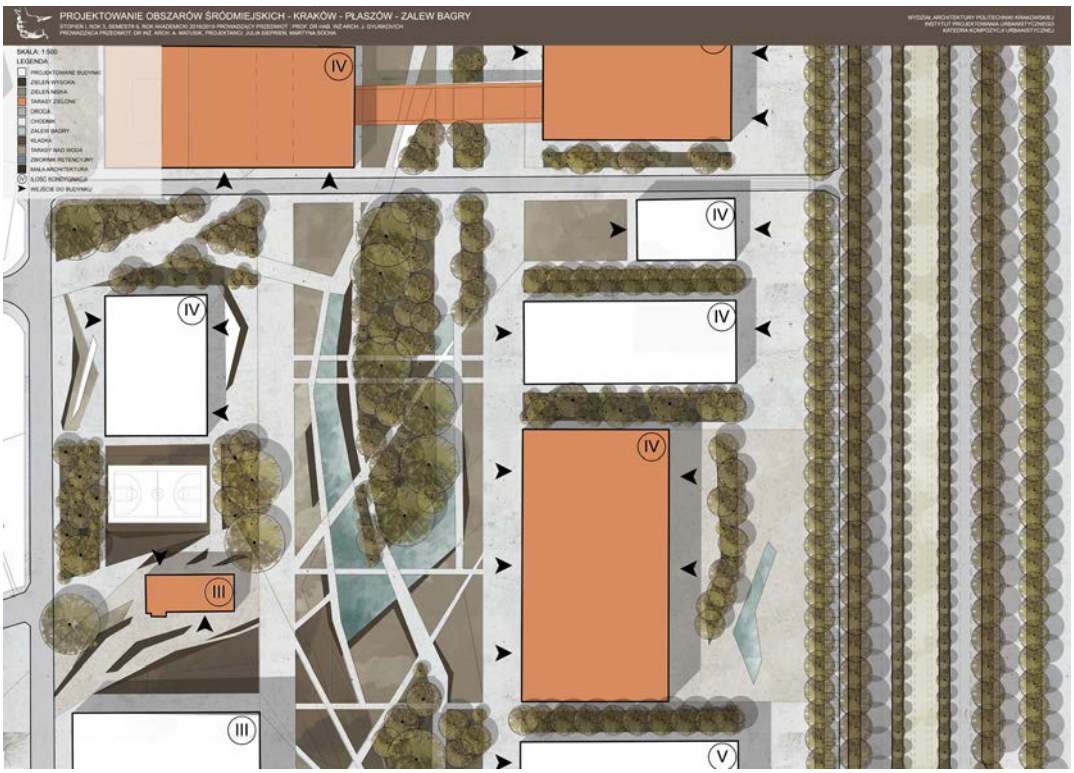

Figure 2: Fragment of a level III design assignment phase, involving individual work (Bagry area development plan, module supervisor: J. Gyurkovich; group tutor: A. Matusik; student: J. Sierpień).

Each phase is associated with a specific scope of knowledge and skills that the students must possess to complete subsequent phases of the assignment. The quality of the final assignments will depend on the quality of the project at each level of the assignment. The training of comprehensively developed skills in organising work within a team that changes its composition over time (the number of team members changes) and gaining knowledge in a manner that is broader than under the conditions of individual work are potentially the greatest assets of this teamwork formula (Table 2). The key is constant student-to-student confrontation with changing teams. This involves discussion and argumentation, which are also essential when facing a client or stakeholder.

Table 2: Organisational skills and knowledge appropriate for each level of teamwork for the first formula.

Level	Organisational skills	Knowledge
Level I Multi-person team	Teamwork organisation (minimum of ten persons); Task distribution - delegating students to subtasks; Work co-ordination using graphical tools.	Multi-layered analysis of urban space; Mastering a diverse set of analytical techniques and formulating conclusions.
Level II Two-person team	Partitioning work for small teams; Assign tasks; Jointly co-ordinate design.	Mastering multi-layered analyses and formulating design guidelines; Mastering development of the contemporary city.
Level III Individual work	Control the scope of work; Co-ordinate the design to achieve coherence with previous stages.	Mastering knowledge concerning the design of public space; Testing individual design assumptions.

FORMULA 2: COMPETITION WITH A DIVERSE DESIGN TEAM STRUCTURE

Formula 2, the second formula, has the structure of a competition. A competition entry project for the International Architecture and Landscaping Competition, Fort's New Life held by the Hugo Kołłątaj University of Agriculture in Kraków was subjected to analysis. The task was financed by the Ministry of Science and Higher Education under contract 514/P-DUN/2019 from the science promotion fund.

Teams from Poland, Germany, Austria and Hungary took part in the competition, which was based on the requirements of an area that was culturally and environmentally significant in the municipality of Zielonki, Poland. The design teams were to formulate a vision for site development of the area and its surroundings in Fort Marszowiec, which is part of the Kraków Fortress [6].

One of the elements of the competition was a new vision of the urban and architectural structure defined by the municipal administration. The competition required design teams to work in an interdisciplinary fashion (Table 3) and address matters of landscape architecture, urban design and architectural design, which influenced the diversity of the teams (Figure 3).

Figure 3: Competition project: second place in the International Architecture and Landscaping Competition, Fort's New Life (first prize was not awarded). Design team: K. Hodor (research and teaching assistant), W. Bobek (research and teaching assistant), A. Matusik (research and teaching assistant), F. Suchoń (research and teaching assistant); students: J. Sierpień, M. Partyka, K. Blukacz and M. Chromik.

In formula 2, diversification was required in the types of team member.

Table 3: Interdisciplinary design team structure.

	Institute of Urban Design	Institute of Landscape Architecture
Research and teaching staff	2	2
Students	2	2

An advantage of the team structure of formula 2 was the inclusion of diverse members. Members must solve design problems and share experience. Confronting assumptions affects all three levels of co-operation (Table 4).

Table 4: Formula 2 - organisational skills and knowledge.

	Organisational skills	Knowledge
Level I (work within the team)	Ability to partition design tasks; Ability to co-ordinate efforts among students from different courses;	Expanding specialist knowledge associated with the competition's subject matter; Gaining knowledge in various

	Ability to identify the knowledge possessed by each team member and assigning them to proper tasks.	specialisations from other team members.
Level II (team-municipal administration)	Ability to identify the potential audience of the design.	Mastering knowledge of the mode of operation of the municipal administration; Mastering knowledge concerning the requirements and expectations of a potential client (municipal administration).
Level III (team post-competition exhibition)	Ability to present a competition project in an attractive and communicative manner.	Enhancing knowledge of engaging in substantive discussion of project outcomes on an international forum.

CONCLUSIONS

The two teamwork formulas presented in this article: conducting the module as a regular design studio, and the competition-based formula, can be a significant aid in improving the quality of future architects' education in studying for the degree of Bachelor of Science in Architecture. Teamwork within different groups is key to understanding how architects work.

Introducing the teamwork formula already during the first tier of study aids students in gaining skills in co-operation and in integrating design operations. Supporting the first formula via the second, competition-based formula, stimulates the subsequent process of enhancing skills and knowledge in formulating and working on interdisciplinary urban and architectural design projects. In this respect, the competition-based formula brings the student close to functioning in the actual world of an architect.

Teamwork is a necessity in educating future architects studying for a Bachelor of Science in Architecture degree. Formulas 1 and 2 allow students to have a deeper understanding of the role of the collective and interdisciplinary character of design. Formula 2, in the author's opinion, allows educators to confront students with a broad spectrum of problems linked to urban design.

Formula 1 tests skills useful in terms of functioning within a team but the second formula focuses on both functioning within a team and on relationships with external actors. The ability to support arguments is essential in designer-client relations, be they a private developer, the municipal administration, a competition jury or a local community.

A competition-based formula enables the student to co-operate in a diverse team (considerably more so than in a regular design studio module), and confront a broader spectrum of actors (municipal administration, local community, private developer). This enables greater independence and responsibility for design work subsequently verified by stakeholders.

With globalisation, collective and interdisciplinary design work becomes essential. A comparative analysis of the teaching outcomes of both formulas is presented in Table 5, which shows the evaluation of the module project defences (formula 1) and post-competition (formula 2).

Table 5: Outcomes for formulas 1 and 2.

Formula	Support of the student by teacher/leader	Student self-organisation in the team	Team diversity	External actor diversity	Teaching
1	High	Medium	Low	Medium	Introverted
2	Medium	High	High	High	Extroverted

Evaluation was performed by the supervisor/tutor team. The findings of the analysis indicate an optimal model would be collective work with high leader involvement (formula 1), followed by providing opportunities for greater student independence with a strong diversification of external contacts (formula 2).

Therefore, there seems to be a transition from an introverted to an extraverted model. Thus, it is essential to educate future engineer architects in the form of regular design studio modules and selective supplementary open competitions with the participation of mixed teams. The combination of both models leads to an increase in competencies in urban design.

REFERENCES

1. Paprzyca, K., An innovative model of co-operation between university, local government and business in the Faculty of Architecture at Cracow University of Technology. *World Trans. on Engng. and Technol. Educ.* 15, **4**, 404-409 (2017).

2. Filipowski, S., Nessel, M. and Romaniak, K., Improving student competence through workshops. *World Trans. on Engng. and Technol. Educ.*, 17, **4**, 483-489 (2019).
3. Wdowiarz-Bilska, M., Competitions with local partnerships as a teaching mode to develop students' learning. *World Trans. on Engng. and Technol. Educ.*, 17, **3**, 283-288 (2019).
4. Ilkovičová, Ľ. and Ilkovič, J., Competition as an activation tool in architectonic education. *World Trans. on Engng. and Technol. Educ.*, 16, **2**, 127-133 (2018).
5. Schneider-Skalska, G., Interdisciplinary education of architects both globally and locally. *World Trans. on Engng. and Technol. Educ.*, 16, **4**, 356-361 (2018).
6. Suchoń, F., *Cracow - City - Fortress*. In: Gyurkovich, J., Matusik A. and Suchoń, F., Cracow: Selected Problems of the Urban Structure Evolution. Cracow University of Technology Press, 273-294 (2016).