

## Sustainability and environmental protection in housing design education

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**ABSTRACT:** The aim of this article is to demonstrate a desirable way of teaching architecture students the principles of sustainable design, instilling in them the language and the culture of sustainability. Mastering these three elements will allow future architects to shape economical, prosocial and beautiful spaces. Effective teaching of sustainable design requires many elements to be taken into account. These are: politics, market, promotion, production and education. Their role and interdependence in the process of sustainability and environmental protection are crucial. Examples of tasks for the first-year of first-degree students and the first-year of second-degree students show the differences in the methodological approach and the required scope of study. Cooperation between Cracow University of Technology, Kraków, Poland, local government, local community and business is the element that contributes to promoting the language and the culture of sustainability.

### INTRODUCTION

Brook Muller, Acting Dean of the School of Architecture and Allied Arts of the University of Oregon said: *As populations increase and the world urbanizes, demands for a more environmentally responsive built environment grow, ...The UO's programs have been committed to teaching and research on energy-efficient design, reuse and adaptive design, ecological design, and green products and practices for decades* [1]. The aim of this article is to present the desired and implemented method of teaching students of architecture the principles of sustainable design, as well as inculcating into them the language and culture of sustainability. Mastering these three components will allow future architects to create spaces that are economical, pro-social and beautiful [2].

Sustainability or perhaps a more suitable phrase would be *working towards sustainability* - as it is a process, refers to and involves numerous groups of stakeholders or actors operating in the space that surrounds us - the space in its physical, economic, legal and social aspects. These stakeholders may be classified into three primary groups: communities, decision makers and investors. Each of these groups needs to expand their knowledge and raise their awareness, so that their resources could be managed properly and they would be able to create a high-quality environment, meeting the needs of its users and taking into account the capabilities of nature.

Bač was right when she said that the principles of working towards sustainability may only become universally understood when the language of sustainability and the culture of sustainability have been popularised [3]. Bač contrasts the high culture of creating sustainable facilities and sustainable environments with the marketing approach, which manifests itself in the pursuit of points scored for implementation of certain specific systems or technologies and obtaining certificates treated as effective means of promoting a given project. It must be observed, however, that these two ways do not exclude each other, and frequently, a certain marketing pressure on obtaining certificates bears fruit after some time in the form of making the language and culture of sustainability more firmly established and recognised.

British experiences in this matter may serve as a good example of the process described above. The evaluation system introduced by SEEDA (the South East England Development Agency) was initially treated as a set of criteria for voluntary implementation, and it was used by developers for advertising their projects. The benefits it brought encouraged other investors to implement the recommended solutions. This, in turn, paved the way for the introduction of government regulations for (then) voluntary implementation in 2006, in the form of the Code for Sustainable Homes drafted by the Department of Communities and Local Government. In the end, the Code was made compulsory in 2015.

Still, the understanding of the value of such regulations was not particularly widespread, which was emphasised by Gwyn Roberts, responsible for Housing Standards at the Building Research Establishment (BRE), *...The Code has been*

*a catalyst for significant positive change in house building - it created a step change in standards, knowledge, products and skills within the sector. However, the Code as a Government standard, hasn't resonated with consumers as this is key to really driving the market further forward. BRE is now working with the industry to do this [4].*

So, BRE is working on a system that would consider the diverse preferences of users to a greater degree and that would be more pro-social and promote creating the culture of sustainability. The social (or pro-social) character of a sustainable environment contains several features, including comfort of use, spatial, acoustic and climate comfort, as well as the freedom of choice, the sense of social cohesion and the sense of responsibility for the environment quality [5].

This requires identification with the environment and understanding of the ongoing processes. More detailed discussion of this topic may be found in Gawlikowska, in which she quotes *inter alia* the popular catchphrase NIMBY - *not in my backyard*, which aptly illustrates the obstacles that are placed in the way of incomprehensible or imposed regulations [6].

## SUSTAINABLE DESIGN IN EDUCATION OF ARCHITECTS AT THE BEGINNING OF THEIR EDUCATIONAL PATH

The problems related to sustainable design and teaching presented in the introduction are very broad. Hence, the way in which knowledge is passed on must be adjusted to the intellectual and perception level of the listeners. Success in developing the language of sustainability and the culture of sustainability depends on how much of the necessary knowledge will be acquired by children, adults, decision makers, investors, in short - all the age groups across all the society. A special role in this process is to be played by people professionally involved in the creation of built environments, including architects, urban designers, spatial planners and land management experts.

This statement particularly refers to teaching students of architecture. Sustainable design, which once seemed to be a novelty and a thing of the future, is now a commonplace for students and future architects and must be so. Examples of tasks assigned to the first- and second-year students of the first cycle study programme and to the first-year students of the second cycle study programme at courses run by the Chair of Housing Environment at the Faculty of Architecture of Cracow University of Technology show the differences in the methodological approach and the required scope of work.

The subject matter is present in the syllabus from the first year of study, in the second semester, in courses named *Introduction to the Theory and Principles of Architectural and Urban Design* and *Introduction to Architectural and Urban Design*. The 15-hour cycle of lectures includes *inter alia* a set of topics called relations between architecture and nature - sustainable design, which feature lectures on the following themes: relations between architecture and nature; sustainable design; contemporary architects and principles of sustainable design; contemporary trends in green areas development; natural components in public and neighbourhood areas or revitalisation - examples.

The subsequent set - *Introduction to Housing Environment Creation* - also features the subject matter of sustainable design in the context of housing environment, which is discussed in the following lectures: the role and significance of housing development in the structure of the city; eco-friendly housing complexes, and the city and the housing environment in the 21st Century.

First-year students learn the principles of sustainable design as proposed by Vale and Vale, who formulated them in a very clear and easy way as: energy efficiency; alternative sources of energy; the 3R principle - reduce, reuse, recycle; respect for people and respect for site [7]. It is also emphasised that the holistic approach is very important for creation of the culture of sustainability and that sustainable design is not a style but a way of thinking.

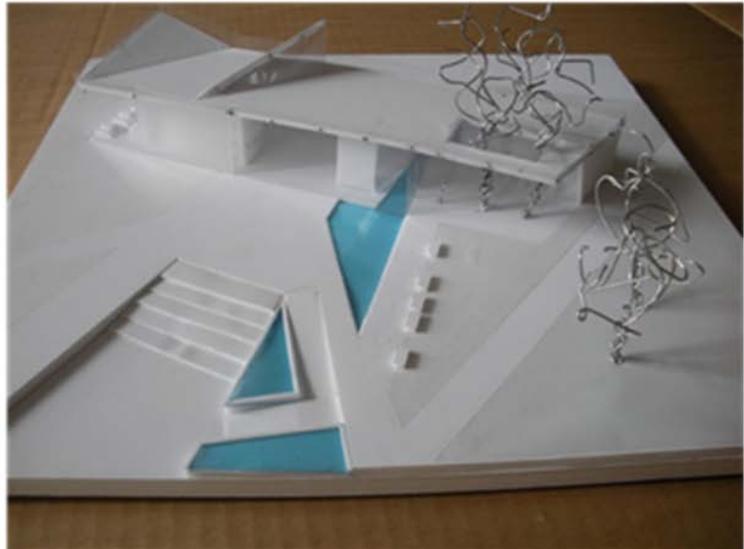
The lectures are accompanied by design classes, which cover a range of topics applying the principles of sustainable design. These were: the concept of housing environment; a public space - an organic produce fair or a pavilion presenting and promoting sustainable solutions. The classes are relatively short, they only run for half a semester, and the sustainable solutions are presented on graphic boards and in the design project description. The classes are combined with seminars acquainting students with certain specific solutions, e.g. types of eco-friendly water treatment plants, methods of collecting rainwater, etc (Figures 1).

Implementation of sustainable design principles is continued in the second-year design class, which focuses on the single-family house and the urban unit of dense single-family development. Solutions related to houses are more advanced than the design projects done in the first year, and the urban design has certain leading motifs, such as houses in greenery; a space for recreation or water in housing complexes. While the focus in house design are technological solutions, the main emphasis in urban design is placed on the social aspects of sustainable design and respect for the site [8].

Engineer's degree diploma projects, done to complete the first stage of the future architect's education, demonstrate a certain degree of mastery concerning the principles of sustainable design and thinking in broader terms than just energy saving. The examples presented below exhibit such elements as setting the designed facility into the urban context, using materials characteristic of a location or considering the need for social interaction and social cohesion.



a)



b)

Figure 1: Types of eco-friendly water treatment plants, methods of collecting rainwater; a) designed by student P. Kaczmarczyk, teacher: G. Schneider-Skalska; b) designed by student K. Starzyńska, teacher: G. Schneider-Skalska (Photographs by G. Schneider-Skalska).

#### WORKING TOWARDS HOUSING ENVIRONMENT SUSTAINABILITY IN EDUCATION

The second cycle study programme involves a considerably broader and deeper knowledge and understanding of the principles of sustainable design. A special role in forming appropriate attitudes is attributed to designing of housing environments, as they are areas of very fragile structure that is not easy to construct, primarily because of the variety of their users/residents' needs and expectations. All these domains and principles of sustainable design should be implemented in these areas.

The Faculty of Architecture at Cracow University of Technology runs the course called *Architectural and Urban Design of Housing Areas*, which is accompanied by another - *Theory and Principles of Design*. The lectures include the following topics:

- housing environment in the structure of the city;
- creating a structure of a housing area;
- comfort in the housing area: spatial, functional, climate and acoustic aspects;
- evolution of forms of living;
- new forms of housing development;
- revitalisation in housing areas; housing environment quality evaluation;
- healthy housing environment - the role of natural components;
- social studies and social participation;
- demographic and economic processes in housing areas;
- housing environment - perspectives, threats, trends.

A broad range of problems refer to spatial, social and economic issues, and the primary objective is designing a healthy housing environment, which satisfies the needs of its residents and considers the environmental-economic capabilities. The design task is always located in a specific town or city, a certain number of which have signed agreements or letters of intent with the Faculty of Architecture at Cracow University of Technology, thus entering into a broad cooperation with the Faculty.

Participation of representatives of municipalities in the teaching process (site inspections, auxiliary materials, discussions and exhibitions) allows students to understand better the specific character and needs of a place, whereas municipal administration officers can be confronted with various concepts of how the spatial problems of their cities could be solved (Figures 2 and 3).



Figure 2: Nowy Sącz - sustainable housing units (designed by students: E. Proszkowiec, K. Fijoł, teacher: G. Schneider-Skalska, cooperation: P. Tor and M. Petelenz).

In the design projects, a lot of attention is paid to the comprehensive approach to the design problem and the quality of the suggested solutions viewed from the perspective of the broadly understood sustainability. The principles of developing functional-spatial models, programming and evaluating solutions are all considered. The design work is preceded by an extensive analysis of the area and needs in the relations mentioned below.

#### INVESTIGATED AREA - CITY/DISTRICT (COMPONENTS CRYSTALLISING THE IMAGE OF THE CITY) AND INVESTIGATED AREA - DIRECT VICINITY

Developing models is based on the theory and practice of the Institute of Urban Design, which has been researching this subject for years, and reinforced by the theory and solutions from abroad, such as the models presented by R. Rogers or the infrastructure systems by Ken Yeang.

Evaluation of solutions is done with the use of grading systems applied internationally, such as:

- the Code for Sustainable Homes, already mentioned in the introduction, which covers nine categories of sustainable design: energy and CO<sub>2</sub> emissions; water; materials; surface water run-off; waste; pollution; health and well-being; management and ecology;
- BREEAM (communities governance GO; social and economic wellbeing SE; resources and energy RE; land use and ecology LE; transport and movement TM; innovation Inn);
- lead for neighbourhood development (smart location and linkage; neighbourhood pattern and design; green infrastructure and buildings).

Principles of sustainable design are implemented in successive design projects all the way up to the Master's degree diploma project, which often deals with topics covering a wide problem area, related to revitalisation or activation of whole urban zones. In these projects, special emphasis is placed on respect for the site and responding to the diverse needs of residents. (Figure 4).

An important, though complementary, role in teaching sustainable design at the Faculty of Architecture of Cracow University of Technology is played by students' research clubs or circles, especially the circles associated with the Chair of Housing Environment - the GROW club and the Sustainable Design Club. Students take part in research programmes and works (Figures 5 and 6).

In years 2005-2007, the Chair of Housing Environment participated in the SUSPURPOL international project, involving three organisations: the Environment Centre (UK), the Andalusian Institute of Technology (Spain) and the Chair of Housing Environment, Cracow University of Technology (Poland). A special benefit arising from the



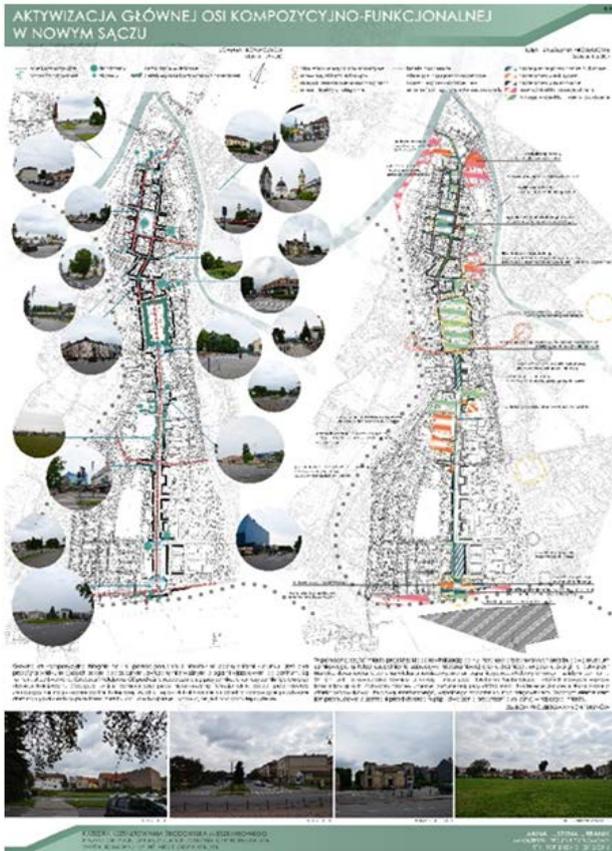


Figure 4: Master Diploma: Activation of the main composition and functional axis in Nowy Sącz, author: A. Urbanik, promotor: G. Schneider-Skalska, co-promotor: Z. Kęsek.



Figure 5: Discussion on sustainability in UK (Photograph by G. Schneider-Skalska).

Figure 6: Discussion on inhabitants needs in Kraków (Photograph by G. Schneider-Skalska).

International exchange of experiences and comparison of teaching methods with the Faculty of Architecture at the University of Portsmouth, also done within the framework of the project, demonstrated that the approach to teaching sustainable design at both institutions was similar and facilitated further cooperation.

In years 2014-15, the Chair of Housing Environment was working on commission from the Municipality of Kraków to prepare a functional and spatial diagnosis of the Olsza II and Ugorek housing estates in Kraków. Students associated with the Sustainable Design Club participated in the work, and thus had the opportunity to meet the challenge of adjusting housing estates from the 1960s and 1970s to the contemporary requirements of sustainability.

## CONCLUSIONS

In conclusion, it should be stated that sustainable design requires extensive and interdisciplinary knowledge. Hence, it is strongly recommended that the courses we run should attract students and lecturers representing a range of fields [9].

If one is to achieve the desired final goal, one finds it necessary to gradually and continuously expand the students' knowledge and skills as they move up onto the successive higher levels of their education. Comprehensive, continuous and sequenced teaching process is indispensable, and so are the knowledge of theory and case studies.

Variety of teaching forms also seems important - learning should take place within the framework of the valid syllabus, in research clubs, as well as other associations and informal groups or in the process of solving local problems.

An important role in teaching the principles of sustainable design and methods of their implementation is attributed to the contact of students with the actual real location which is undergoing transformation. Cooperation with the economic environment and local administration should provide students with the necessary reference to reality. Cooperation among the university - local administration - local community - business is the element that contributes to inculcating in students the language of sustainability and the culture of sustainability.

Effective teaching of sustainable design requires consideration of all the involved entities and components. These are: politics, market, promotion, production and education. Understanding their interrelations in the process of environment protection and working towards sustainability is of key importance.

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