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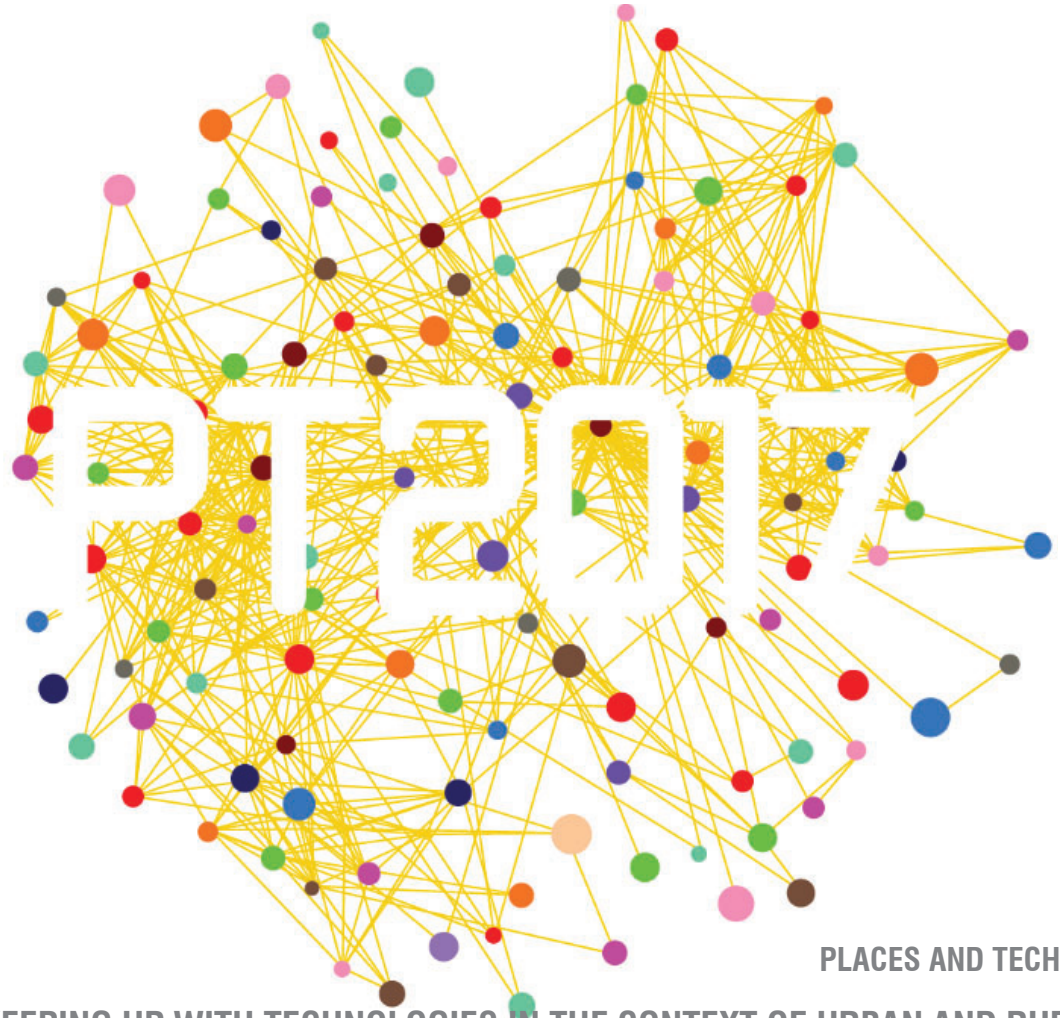

PLACES AND TECHNOLOGIES 2017

KEEPING UP WITH TECHNOLOGIES IN THE CONTEXT OF URBAN AND RURAL SYNERGY

Book of Conference Proceedings

Sarajevo, Bosnia and Herzegovina, June, 08th - 09th, 2017

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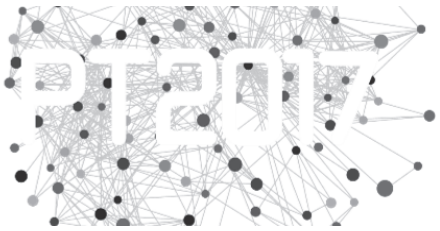
BOOK OF CONFERENCE PROCEEDINGS

Editors:

Dženana Bijedić, Aleksandra Krstić-Furundžić, Mevludin Zečević



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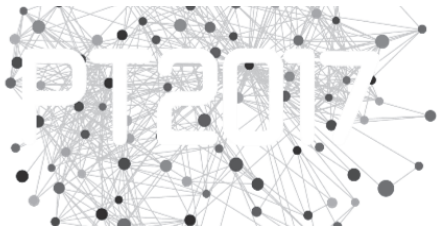
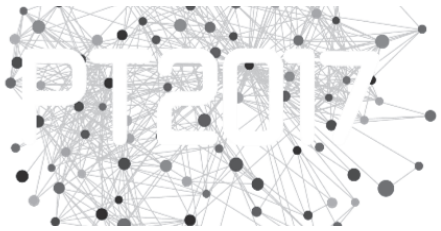
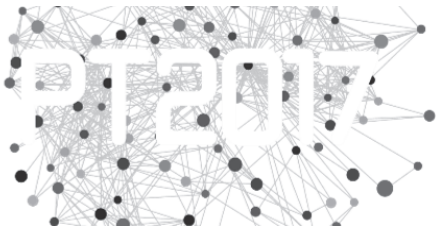
CONTENTS







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INTEGRATED DESIGN IN THE PROCESS OF ARCHITECTURAL EDUCATION

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ABSTRACT

Integrated design represents a contemporary approach of conceiving and development of building projects. It is defined as a design which results in buildings that successfully perform their function, in accordance with all aspects of sustainability: social, economic and environmental. The key issues to be considered during the design are related to the environmental protection, with special emphasis on harmful emissions, energy efficiency and materials and waste, as well as to the social benefits for building users, with special emphasis on protection and safety, comfort, spatial organization, space adaptability, maintenance and visual stimulation. This approach implies that different disciplines are involved in the decision-making from the very beginning of design process, with the idea to respond to the increasingly complex requirements. The paper discusses the innovative educational model, partially applied within the studies of architecture at University of Belgrade, which should address this new reality. Whereas integrated design requires system thinking and continuous interaction of all participants in the design process, research strategies that cross the boundaries of individual disciplines are applied. The learning is based on the integration of the theoretical knowledge in the field of architecture and engineering in function of problem-solving. It implies a holistic view on the design, within which education, research and practice are integrated into a single process that encourages critical thinking directed to multidisciplinary optimization of design solutions. The basic elements of the discussed educational model are presented in this paper, as well as its potential and limitations.

Keywords: Integrated design, Architectural education, Design studio

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TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

INTRODUCTION

In the last decades increasing criticism of the traditional approach to education of architects can be seen, as well as significant changes in architectural design education. The basic assumptions, theories and practices are reconsidered (Al-Qawasmi and Velasco, 2006). One of the main deficiencies of the existing systems of education is the absence of multidisciplinary, integrating and systems approach (Devon et. al., 2004). Bearing in mind the increasing complexity of architectural practice and the introduction of new sustainability criteria, concerning the reduction of the negative environmental impacts with a simultaneous increase in quality of life (Working Group for Sustainable Construction, 2001), it is necessary to redefine certain educational concepts.

Architectural space planning based on the principles of sustainable development requires a qualitatively new approach to the design, that is, integrated approach based on the system analysis of social, economic and environmental aspects (Birkeland, 2002). Integrated approach to building design implies the active, continuing and organized collaboration of architects, users, code officials, building technologists, cost consultants, civil engineers, mechanical and electrical engineers, structural engineers, specifications specialists, and consultants from many specialized fields. In this process architects and engineers work together as a collaborative design team from the early stages of design. To provide effective processes and methods in context of sustainability architectural educators must clarify the goals, approaches, and outcomes. "The educational challenge is to design a curriculum that captures the complex design processes, methods, and integrated thinking" (Guzowski, 2011). Architectural education should be the framework for establishing connections between parties which are mainly isolated or antagonistic in traditional system of education. "The academy can become an instance of discussion, publication and instruction that brings together students, practitioners, clients, the public sector, media channels and research councils" (McQuillan, 2005).

INTEGRATED APPROACH TO DESIGN - INNOVATIVE EDUCATIONAL MODEL

The paper discusses the following basic elements of innovative educational model, partially applied within the studies of architecture at University of Belgrade, as well as its potential and limitations. The presented educational model should serve as a basis for the creation of curriculum which will enable adequate participation of students of architecture and other disciplines involved in the design of buildings in the complex process of integrated design.

Work in studio

Studio is a pedagogical construct which involves three basic functions: information seeking, new knowledge generating and decision making. Studio teaching should simulate design practice based on client interaction (Sorvig, 2005) and environmental concerns (Radivojević, Ćuković Ignjatović, and Nedić, 2010). It should be based on and real-world projects in order to integrate education, research and practice into a single process (Incedayi, 2005). In addition, the work in studio should be based on multidisciplinary, integrating and systemic approach. However, the interconnection of architecture students with other disciplines is usually not present within traditionally conceived studio (Lueth, 2008). This interconnection needs to be established, primarily in the function of expanding the research base (Boyer and Mitgang, 1996). In this regard, it is necessary that architectural design studio became the place where all involved disciplines are transformed into a synthesis (Incedayi, 2005).

Studio teaching should combine three methods of education: teacher-centered method – in function of theoretical knowledge transfer; student-centered method – in function of search, collection and aggregation of knowledge, that includes active participation of students under the supervision of educators which should help students to build up a consistent mental model in the subject matter; and finally, teamwork-centered method that implies creation, construction and development of knowledge, in order to encourage innovation. It is working on solving unique and complex problems, that is, where outcome is not predetermined. In this process the differences between students and educators concern the experience and theoretical knowledge.

The individual and team work are encouraged. Individual work is related to creative input, especially in the phase of concepts creation, as well as to motivation for work, whereby design is seen as a competition (Anthony, 1991). The goal of group work is to encourage collaboration, that is, group learning and designing, during which students “create and share knowledge, and invent new design solutions” (Cramer, 2011). The objective of group work is also to prepare students for practice, given that effective architectural practices are associated with the culture of teamwork and collaboration (Nicol and Pilling, 2000).

In this process it is important to avoid “one-sided thinking” trough more emotional experience throughout the act of design. The educators should allow the felt world to infiltrate and if necessary disturb the architectural know-how (Levitt, 2007). In addition, bearing in mind that new forms of knowledge should be to developed, education should primarily “develop judgment rather than to package up knowledge” (Hughes, 2003). It is necessary to develop critical thinking directed to multidisciplinary optimization of design solutions. Students should critically rethink design situation, not just to accumulate knowledge and information.

TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

Integrative approach to architecture

Design of buildings in function of achievement of ecological quality is the design according to requirements that building as a whole need to comply, based on targeted integrated building performances during its life cycle. It is process in which the requirements for performances are translated and integrated in building solution (Spekkink, 2005). Integrated project objectives derived from indicators of ecological quality[85] become the basis for the design. The key issues to be considered during the design are related to the environmental protection, with special emphasis on harmful emissions, energy efficiency and materials and waste; the social benefits for building users, with special emphasis on protection and safety, comfort, spatial organization, space adaptability, maintenance and visual stimulation; and economic benefits for building users, with special emphasis on operating and maintenance costs, building's usefulness and financial affordability (Nenadović, 20014).

The integrated design is based on the principle of contextuality, which implies that any solution results from its inherent set of parameters. In addition to the integrated project objectives, which can be considered global, the outcome will be affected by conditions of the local environment, which may be interpreted as limitation, but also as potentials (Nenadović, 2014). In this context, the work in design studio should be based on solving real-world problems.

In the process of architectural education integrated design should encourage the development of system thinking, through research strategies that cross the boundaries of individual disciplines, and also to develop individuals who are sensitive to the environment and capable of designing and transforming the world on the basis of this sensitivity (Incedayi, 2005). The aim is to move from designing “objects” to designing “relationships” (Reed, 2006). In that context, design educators must teach in ways that foster a more synthetic, concurrent, and dynamic integration of design issues, with a constant awareness that design is “creative activity, involving imagination, intuition and deliberate choice” (Arup and Partners, 1986).

Multidisciplinary approach

Integrated design is a holistic approach, which requires systemic thinking and continuous interaction between all participants in the design process. It is based on a multidisciplinary team whose members make decisions together in accordance with a common vision and a holistic understanding of the project (Ritchie, 1995). Complete design team is involved in the design process from the beginning, allowing early changes and improvements. In this process the architect becomes a strategic organizer of multiple, often disparate forms of knowledge and processes (Moe, 2008). However, in schools of architecture supremacy still belongs to individual (Nicol and Pilling, 2000), which does

[85] Ecological quality can be interpreted as the extent to which performances of the building meet the needs and expectations of its users, which refer to social and economic well-being achieved with simultaneous protection and improvement of the environment throughout the life cycle of the building (Nenadović, 2014).

not prepare students to real conditions in architectural practice, where they will face with the role of integrator (Worthington and Orbasli, 1996). In terms of educational requirements, it becomes increasingly important to train architects to work collaboratively and effectively with many other professionals in the building process. Various subjects should be included in the curriculum, which gives the opportunity to explore the different dimensions of the design process. Students from other disciplines should come to the studio, working side by side on the same project (Lehmann, 2006), with the participation of educators and experts from different fields, thus making a multidimensional approach the focal point of education. Educational institutions should develop common interdisciplinary platforms using new technologies and media. New dynamics developed through interdisciplinary dialogue could contribute in a fundamental way to the educational process (Incedayi, 2005).

Integrated design process

In order to simulate integrated practice, students of architecture and other engineering disciplines need to work together in a studio on a project that is "real world problem". All indicators of sustainability should be analyzed through collaboration. Collaboration among students is encouraged from the very beginning, in order to blur the boundaries between disciplines and to assure the transfer of information and knowledge, that is, to provide relevant inputs. The educators from various faculties, as well as experts from practice for each individual field, are included in the work in studio. The objectives and outcomes for each subgroup of students are defined, in order to minimize unwanted omissions. The process takes place through the design charrette, that is, through focused and collaborative brainstorming sessions that encourages an exchange of ideas and information and allows truly integrated design solutions to take form. All participants are encouraged to cross fertilize and address problems beyond their field of expertise. Architectural educators and students of architecture are facilitators of all knowledge in this process. The phases of the process are:

- Research of literature and analysis of project examples and realized buildings - critical rethinking of examples from the architectural practise derived from the process of integrated design.
- Simultaneous consideration of the potentials and limitations of the environment in which the building is implemented and the integrated project objectives.
- Work on the creation of concepts that takes place through collaborative brainstorming sessions.
- Nonlinear, iterative design of the building that takes place through critical debates between all the participants in the design process, with the aim to achieve adequate building performances.
- Evaluation of the solution from the standpoint of all participants in the design process and final corrections - performances evaluation - evaluation is based on an aggregation of fact and value judgments.

APPLICATION OF INTEGRATED APPROACH AT FACULTY OF ARCHITECTURE

The presented innovative educational model, that should address new reality, is partially applied within the studies of architecture at University of Belgrade. In the course "Studio project – Project development" two fields of research are integrated within the studio, the field of architecture and the field of structural engineering, with the participation of educators from individual disciplines. The outcomes are wider knowledge base, greater understanding of the problems of individual disciplines, as well as greater ability to integrate acquired knowledge in practice, through simultaneous development of students' and educators' creativity. This model is becoming more common in extracurricular students' activities, through full integration of all disciplines involved in the process of building design. An example is common work of students from different faculties, educators from different disciplines and experts from practice on development of project for the Solar Decathlon Middle East 2018, through the implementation of an integrated, multidisciplinary approach to design. The examples of application of integrated approach to education of architects and engineers are still fragmentary, given the fact that systemic reform of the educational process is lengthy and complex process.

INTEGRATED APPROACH'S POTENTIALS AND LIMITATIONS

The potentials of the presented educational model:

- Creation of new knowledge and widening of the research base, as a result of integration and synergy of topics and disciplines in the framework of the design studio.
- Development of students' creativity, considering the new requirements that lead to non-standard solutions, that is, focus on intuition and imagination which are the basis of this type of design.
- Development of students' ability to solve specific real-world problems, and thus their greater ability to work in architectural practice, as a result of the integration of theoretical knowledge, research and practical work in the framework of the design studio.
- Development of students' ability for collaboration and knowledge transfer, as a result of early involvement of different disciplines in the design process and teamwork on solving design problems.

The limitations of the presented educational model (which should be overcomed):

- Educators are narrowly specialized which makes their transition to system thinking harder. They should be further educated and trained. During the model implementation, improvements in educators' approach to design are expected, that is, further development of system thinking during the process of integrated design in studio.
- The current design process is mostly based on a linear approach, in which the architect through individual work produces the solution, while other participants take part in later design stage, that is, in the phase of project development. This ingrained way of designing represents a constraint for architectural educators and for educators from other disciplines, given that new design process implies collaboration of all parties from the very beginning. During the model implementation, gradual adaptation of educators to a new work model that integrated design implies is expected.
- The presented educational model implies continuing education of all educators, which should be institutionally provided and which should give the access to the new current knowledge in the field of sustainable construction.
- The implementation of presented model implies development of common interdisciplinary platforms for exchange and integration of information and knowledge.
- Multidisciplinary optimization implies development of methods for efficient transfer of data between disciplines, related to the achieved building performances, in function of their evaluation. It is necessary to develop building modelling methods, which should be based on related models of different disciplines. A particular challenge concerns the development of efficient simulation tools for modelling and analysis, which integrate different physical phenomena.
- One of the key limits to the implementation of presented educational model in the regular classes is the current mode of organization of universities and individual faculties related to the process of building design. It can be noted that there is a low level of cooperation and insufficient knowledge exchange. In order to implement the presented innovative educational model, it is necessary to reform the existing plans and programs at individual faculties, as part of a joint reformation which will include harmonization of objectives and expected outcomes of teaching, coordination of teaching hours fund and allocation, as well as provision of necessary space and equipment.

CONCLUSIONS

The presented innovative educational model is based on work in studio, integrative and multidisciplinary approach to architecture and integrated design process. The main goal within this model is to train students of architecture and engineering for optimisation of the design solution based on multiples analysis of many aspects of ecological quality, through application of research strategies that cross the boundaries of the individual disciplines, as well as through study of the problem of system-building from the perspective of different interactively connected disciplines. The model relies on holistic view on design, where education, research and practice are integrated into a single process within which critical thinking is encouraged, based on assumptions and questions concerning the finding of many

possible solutions. The complex nature of this type of design leads to widening of the knowledge base and scientific interpretation of the research field of architecture at the contact areas of research. The integrated design should enable students to comprehend the complex interdependences of multiple aspects in the field of architecture directed towards achieving the ecological quality of buildings. It should also enable deeper and fuller understanding of complexity and plurality of responses in the area of architecture directed towards the sustainability.

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