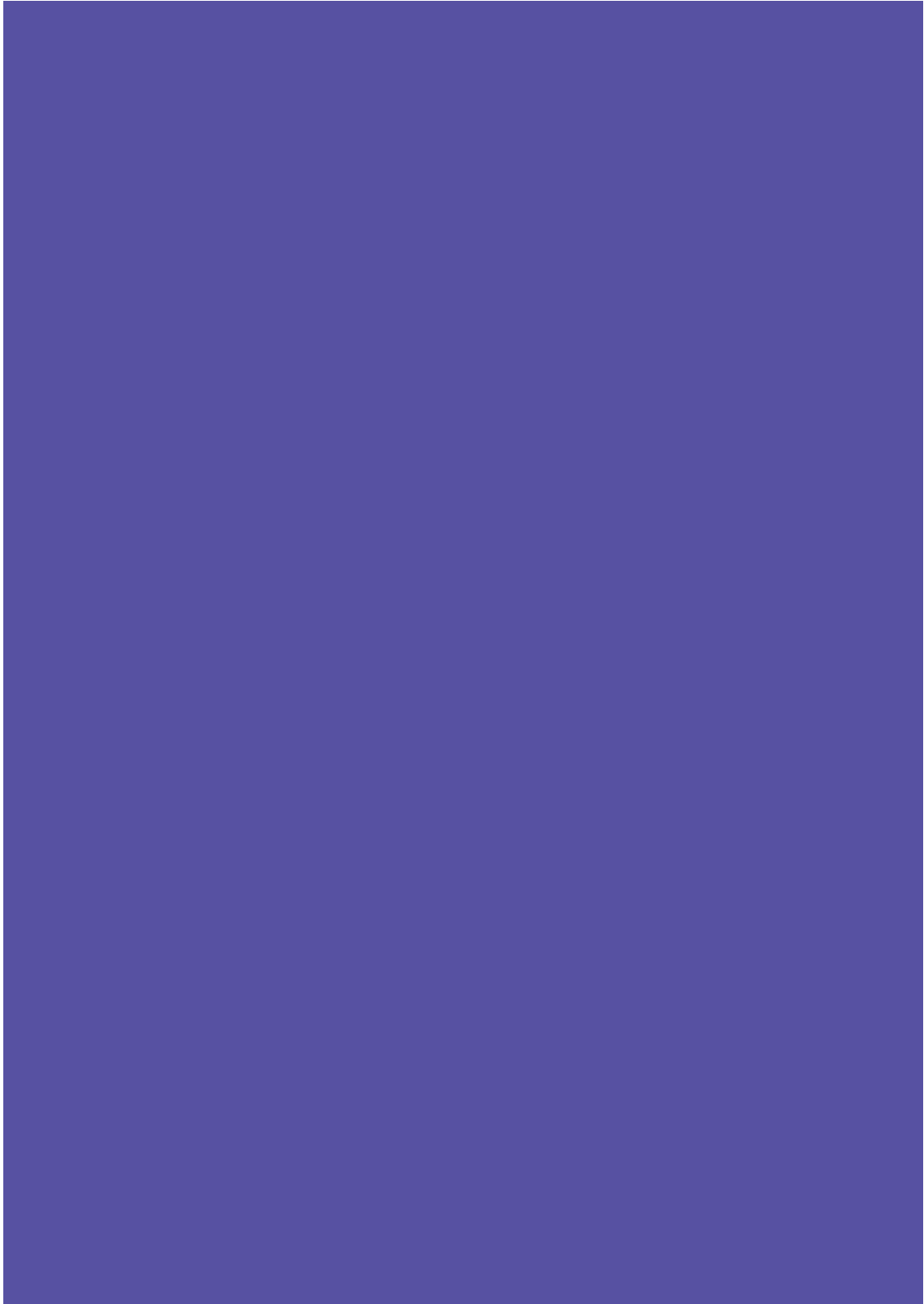


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PLACES AND TECHNOLOGIES**

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PLACE-BASED URBAN DESIGN EDUCATION FOR ADAPTING CITIES TO CLIMATE CHANGE

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ABSTRACT

Climate change and its impact on human settlements create a new context and purpose of urban design education. It asks for new knowledge and skills, but most of all it changes the way in which we think about the future of cities and about our capabilities to shape it. Future urban designers should be prepared to work in the world they can't totally control, in which resilience and adaptation are becoming the key words. We argue that this shift in the mind-set and professional capabilities cannot be done in one single urban design class or studio (nor only in the field of urban design as part of architectural education), but needs continual and evolving development of knowledge and skills, as well as possibilities to explore different learning and design approaches. At the same time, though climate change is a global problem, it needs local and place-based responses if urban resilience is to be achieved and sustained. In this paper we present two models of urban design education and discuss their capacity to integrate climate adaptation issues into the process of architectural education. These educational models were developed at the University of Belgrade Faculty of Architecture for two different levels of higher education, at bachelor ("Sustainable urban communities studio") and master of architecture ("Ecological urban design studio") levels. Both models were developed under the theoretical framework of place-based education, but apply it in different ways in relation to purpose, focus, methods and expected learning achievement.

Keywords: urban design, climate change, adaptation, place-based education

Introduction

Cities are responsible for GHG emissions - both directly as generators of such emissions and indirectly as end-users of fossil fuel based energies, goods and services, and consequently viewed as strategic vehicles for climate change mitigation (UN 2011). At the same time, urban areas, where the majority of the population lives, are especially vulnerable to the impacts of climate change due to their high population density and physical structure (The World Bank 2010). Demands for minimizing carbon emissions and adapting to climate change can be perceived as constraints to urban development, but designing in a climate sensitive, carbon-neutral and adaptive way also opens new possibilities for cities to improve different environmental features so as to become better places to live and invest (CABE 2008). This new context calls for the change in the way we think about cities and of possibilities to shape their future in the world we can't totally control. It implies a shift in the mind-set of urban designers and development of the new professional capabilities, new knowledge and skills. This leads to changes in urban design professional practice, but also to changes in urban design education. In last decade debate on *how to link climate mitigation and adaptation to architectural and planning education* is developed, leading to development and assessment of different

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learning approaches (ThePen resolution 2011).

This paper attempts to contribute to this debate by exploring the ways in which *climate adaptation issues* can be integrated into *education in urban design*, in order to identify opportunities and constraints of different learning models based on place-based education. The first part of the paper explains the problem of climate adaptation, the main exposure units to climate change in urban areas as well as the main adaptation policy areas that make an influence to urban design. In the second part, basic formats and approaches to urban design education were explained and need for place-based education is recognised as an important for adapting cities to climate change. Third section presents a comparative analysis of two urban design courses as case studies, developed at the University of Belgrade Faculty of Architecture for two different levels of higher education, at Bachelor of architecture ("Sustainable urban communities studio"²) and Master of architecture ("Ecological urban design studio"³) levels. Both courses were developed under the theoretical framework of place-based education, but apply it in different ways in relation to concept, content, methods, structure and process and expected learning outcomes.

Adapting cities to climate change & urban design

Climate change refers to change in climate patterns such as global warming, changes in dynamics and intensity of precipitation, and an increase in the frequency of extremely high air and drought periods. Experts have a clear consensus that more and more dramatic events, such as floods and storms, will increase as temperatures rise. Sea and ocean levels will rise, summers are likely to be hotter and drier, while winter will be wetter and storms more intense, and (NCRA 2007). Due to the high density of population and construction, cities are particularly sensitive to climate change, but are at the same time responsible for GHG emissions that intensifies change of climate (TCPA 2007). Consequently, the climate-responsible approach to urban development emphasizes the need for activities to minimize negative impacts on climate, and the need for cities to adapt to the consequences of climate change that can not be avoided. Review of literature reveals three main exposure units to climate change in urban areas: building integrity, urban green space and human health and comfort (Živković&Lalović 2011):

- **Building integrity** means that both buildings and infrastructure are at risk to increased coastal, fluvial and pluvial flood risk as well as by shrinking and swelling of the ground erosion. These impacts depend on the type of urbanization, which alter natural hydrological regimes through reducing the infiltration capacity of the ground
- **Urban green spaces** are important for improving the climate conditions and combating the threats induced by climate change, but they can also be affected by the change of climate. Limited water resources may cause the problem in managing and effectiveness of urban green space and therefore various methods which allow rainwater harvesting, re-use of grey water, and making use of water in rising aquifers under cities should be employed
- **Human comfort and health** in urban areas are threatened due to rising temperatures and more intense rainfall events with associated flooding. It can be expected that climate change will affect people's demand for, use of, and experience of open space. Natural venting and shading, accessibility, quantity and quality of green and blue space areas, which can moderate temperatures and enhance human comfort, are for that reason of main importance

Taking into account the main exposure units to climate change in urban areas, local govern-

2 The author of the course design and course leader of "Sustainable urban communities studio" is Ksenija Lalović

3 The author of the course design and course leader of "Ecological urban design studio" is Jelena Živković

ments are taking actions to help their cities adapt to future climate change through physical changes of buildings and open spaces by implementing measures in urban design at different urban scales – multi-scalar approach (Table 1.).

Table 1: The link between policy and urban climate scales (GLA 2006)

PHYSICAL SCALE	POLICY SCALE	URBAN CLIMATE SCALE
INDIVIDUAL BUILDING /STREET (FAÇADE AND ROOF CONSTRUCTION MATERIALS, DESIGN AND ORIENTATION).	BUILDING REGULATIONS AND BUILDING CONTROL URBAN DESIGN STRATEGY LOCAL DEVELOPMENT FRAMEWORK	1 – 10 M. INDOOR CLIMATE AND STREET CANYON
URBAN DESIGN (ARRANGEMENT OF BUILDINGS, ROADS, GREEN SPACE)	URBAN DESIGN STRATEGY AREA ACTION PLAN LOCAL DEVELOPMENT FRAMEWORK	10 – 1000 M. NEIGHBOURHOOD SCALE, SUB-URBAN VARIATIONS OF CLIMATE
CITY PLAN (ARR. OF COMMERCIAL, INDUSTRIAL, RESIDENTIAL, RECREATIONAL AND GREEN SPACE)	SUB REGIONAL SPATIAL STRATEGY REGIONAL SPATIAL STRATEGY	1 - 50 KM. CITY/METROPOLITAN SCALE, UHI FORM AND INTENSITY.

Content analysis of various urban climate adaptation strategies (Živković & Lalović 2011). reveals three main adaptation policy areas: flood, overheating and droughts/water management in which urban design plays significant role. Measures for reducing and managing flood risks include: *safeguarding of land, use sustainable drainage systems (SUDS), use green infrastructure, provision of temporary water storage capacity, etc.* At the same time, since average annual and seasonal temperatures are likely to continue to rise, adapting cities to overheating is necessary and relates to: *good quality green infrastructure, accessibility of blue space, shading and passive ventilation, use of cool pavement materials.* Spatial policies and measures for managing expected droughts and water shortage include: *creation of upland and lowland reservoirs, use of SUDS, providing space for treatment of storm and waste water, etc.*

Presented general main exposure units to climate change in urban areas and related measures need to be implemented in a locally specific way, because climate change doesn't affect areas on Earth in the same way. All of this puts forward the importance of knowing and understanding specific local environmental conditions, while looking for adequate and *place-based design* responses to climate change challenges.

Urban design education

Learning Formats and Outcomes in Urban Design Education

Urban design education is oriented towards the development of student's awareness, knowledge, skill and abilities in relation to urban space as expected learning outcomes. It is grounded in Bloom's definition of educational objectives, according to which any given learning task favours one of three psychological domains: a) cognitive, that revolves around knowledge, comprehension, and critical thinking; b) psychomotor, that involves manipulative or physical skills; and c) affective, that describes the way people react emotionally, and relates to development of values, appreciation, empathy, and attitudes that result from the learning process

(Milovanović-Rodić et al. 2013).

This goal can be achieved through *four main educational formats*: seminar, studio, elective courses and workshops. Although learning about urban and urban design theories through transmission teaching model mostly happens in seminars, basic unit in most bachelor and master urban design academic programs is urban design studio. Work in urban design studio enables students to connect theoretical knowledge with urban design methods and techniques while working in a specific urban context (Milovanović-Rodić et al. 2013). Besides seminars and studios, smaller, elective courses and workshops are widely used as an opportunity to apply problem-based learning approaches that teaches not only the facts but also the relevant thinking strategies (Altomonte2012). Traditional author-oriented and transmissional model of urban design education, featuring solipsistic, elite, and abstract design practices, is nowadays starting to be replaced with a *place-based approach*.

Place-Based Approach to Urban Design Education

The premise for grounding education in urban design to place-based learning is that the prevailing author-oriented model of urban design education reduces studio works to passive abstract practices, disciplinary content and technological skills, distanced from natural, social, and cultural realities, and dismisses the idea of place as a primary experiential and educational context (Gruenewald 2003a). Instead, places are conceptualised as “*centres of experience*” that are profoundly pedagogical (Gruenewald 2003b). They are meaningful contexts of human perception of and participation in the world, and are shaped by our experiences and cultural tools we employ to make sense of them

Place-based education is an approach to learning that builds upon natural and human geographies of place to create authentic, meaningful and engaging personalized learning experiences for students. Place-based teaching and learning are situated in places, promote learning rooted in local conditions and use local surroundings as a context to integrate curriculum into wider society (Živković, Đukanović & Radosavljević 2017). Place-based curriculum seeks to establish different connections with the environment and to motivate students for deeper engagement with surroundings in order to promote local sustainability. It is cross-disciplinary and intercultural, informed and contextualised by the natural, cultural, and socioeconomic attributes of places that are studied (Semeken 2012).

Place-based urban design education models for adapting cities to climate change

This section presents two place-based teaching and learning models from University of Belgrade - Faculty of Architecture, and discuss their potential to integrate climate issues into concept, structure and process of urban design education. Model 1 – Studio 02a: Sustainable Urban Communities Studio was designed for Bachelor of Architecture level of study, and Model 2 – Studio M01U - Ecological urban design (EUD) for Master of Architecture level of study. Both courses introduce new topics and innovative urban design teaching and learning approaches to education of future architects and urbanists, important for urban development in the context of the multilevel social, economic, political and cultural transition of Serbia.

Model 1 – Studio 02a: Sustainable Urban Communities (SUC) – Bachelor of Architecture

Study Unit Studio 02a: Sustainable Urban Communities 10 ESPB encompasses theoretical (Seminar) and practical (Project) lessons that are designed to enable students to acquire a complex structure of knowledge and skills in a collaborative relationship. Each of the levels of learning represents a methodological and logical whole that provides students with different packages of understanding, knowledge, abilities and skills (Table 2.). Method of carrying out the-

oretical and practical learning is based on 4MAT didactic pedagogical model (McCarthy, 2000, McCarthy, Germain, & Lippitt, 2002) and combines several methodical tools and techniques, such as interactive presentation, focus group, comparisons, critical discussion, auto reflection and reflection, carrying out the process of student cognition through 4 methodical phases: *1. understanding meaning why?, 2. adopting concepts what?, 3. acquiring skills how ?, 4. adaptation what if ?(Figure 1.). Each of the levels of learning represents a methodological and logical whole that provides students with different packages of understanding, knowledge and skills in relation to climate change adaptation.*

Table 2. - Studio 02a_ Sustainable Urban Communities (SUC): Teaching goals, content and learning outcomes

Studio 02a_ Sustainable Urban Communities OASA 24072__PROJECT_8ESPb_2x3hours	Studio 02a_ Sustainable Urban Communities OASA 24071_ SEMINAR_ 2ESPb_ 2 hours
Teaching Goals	
Mastering the basic methods, techniques and tools in conceiving and designing sustainable urban communities. Further develop and deepen the acquired basic skills of urban design through exploring the possibilities of operation within the more complex urban units in a real environment. To master the methods and techniques of the offered solutions evaluation in accordance with the set goals.	Developing understanding of sustainable development approach and knowledge on sustainability concepts, principles and measures in urban design, specific urban phenomena and the problems of their transformation according to the principles of sustainability in the observed socio-economic context. Introduction to basic methodological approaches to sustainable urban design.
Content	
The task is to explore the possibilities of transformation of community life quality within the smaller urban area in accordance with the principles of sustainability. On the basis of an integrated analysis of the territory to understand the context, students have the task to define, conceptually conceive and develop quality urban design propositions for in accordance to recognised sustainability issues. The methodology encompasses 3 levels of the sustainability cognition: 1) macro, conceptual, strategic level e; 2) mezzo, urban plan level to comprehend sustainable articulation of programs and spatial arrangements of the whole settlement; 3) micro, urban design level to focus on the possibilities of improving sustainability of urban tissue through architectural articulation.	Seminar teaches and discusses contemporary conceptual settings of sustainable urban communities. The first part introduces principles of achieving urban sustainability and their relational connection with the specifics of the social, economic and cultural context of both the natural and the urban environment; an integral model for encompassing the complexity of reality - basic research methods and techniques in relation to urban structure, individual and social needs and their manifestation in the physical space. The second part is focused on key sustainability issues and topics of urban community development: through good practices research and group analysis.
Learning outcomes	
Knowledge and understanding of the complexity of urban structure and causal links between urban entities of a different spatial level, to formulate goals and tasks of the urban and architectural acting in space and to identify the effects of such action on the sustainable development of the community. Ability and skills to apply basic urban analytical techniques and a comparative case study method in the process of searching for possible directions of action in a given spatial unit, to articulate new sustainable spatial solutions on a regulatory, functional and design level, to use basic urban design techniques, to use quantitative and qualitative evaluation techniques, to critically reflect, systematize and present analytical results.	Awareness and understanding of basic aspects of modern concepts of sustainable urban communities and their applications in the observed social, economic and spatial context. Basic knowledge of integrated methodological approach to research and assess the quality of complex urban areas in relation to the principles of sustainability, of methods and techniques of human needs research, of the case study method in the research of good/ bad practices. Ability and skills to use case study method to recognize and understand the structural characteristics of urban communities and to identify goals and tasks of the urban and architectural acting in space identifying the effects of such action on the community sustainability.

lessons and tasks for group and individual work, that are designed to enable students to acquire complex and deep awareness, knowledge, skills and abilities in order to design place based ecological urban design project (Table 3). Studio, seminar and workshop are organised as a complex system of abstract (theoretical) and experiential learning cycles (concrete experience, reflective observation, abstract conceptualisation and active experimentation; Kolb, 1984), that *combine research and design phases* and weave together to help students produce design project at different spatial scales and at the same time gain wider theoretical and practical knowledge, skills and abilities on urban design and environmental issues (Fig.2) .

Table 3. - Studio MO1U - Ecological urban design (EUD) Teaching Goals, Content and Learning outcomes

Studio MO1U - PROJECT MASA – U11011, 15ESPb	Studio MO1U - SEMINAR MASA – U11012, 4ESPb	Studio MO1U - WORKSHOP MASA – U11013, 1ESPb
Teaching Goals		
Developing knowledge and awareness, and training students for application of ecological approach in the field of urban design through: a) Considering the relationship between nature and culture in a specific context, b) Integrating theoretical and experiential knowledge into the process of urban design at different problem and spatial levels, c) Encouraging creativity in place based and place specific design responses .	Developing knowledge on ecological theories, principles and measures for their realization in urban design. The issues and topics of seminar are focused on sustainable and climate-resilient development	Acquiring additional knowledge and skills through individual practical experience, about practical procedures that influence the quality of the project; developing creativity and ability to quickly and efficiently make design decisions and reflect upon results .
Content		
The task is to develop eco-district while focusing on the quality and role of public space in achieving urban sustainability and resilience. The course is structured through different steps in general and focused work on: 1) Research (theories, concepts, models of urban design , good practice, urban spatial and development context and local places) 2) Project (conceptual, thematic, structural and detailed level)	Seminar teaches and discuss general and special topics of ecological urban design .The first part of seminar introduces ecological design theories and concepts and general approaches to sustainable and climate-resilient development in theory and practice. The second part is focused on key issues and topics of ecological urban design: landscape and nature, mobility, energy, waste, community and place architecture/building.	The task of EUD workshop is to conceptualise, design, implement and document a mini-spatial intervention that reveals and re-examines the relationship between man and nature in urban space on specific location.
Learning outcomes:		
Knowledge and understanding of: the needs and aspirations of users and local places and contexts; issues of environmental protection, sustainability and climate resilience in relation to buildings and facilities Ability and skills to and apply ecological approach to research and assess of the quality of urban space; develop critical approach to design projects; apply theoretical concepts in spatial design; prepare and present design projects of different scales, complexities and typologies.	Awareness and understanding of the inter- relatedness between the urban development, design and the environment; Knowledge of ecological theories of urban planning and design, ecological approach to research as well as of the key themes in developing sustainable and resilient cities. Ability to relate theoretical knowledge with urban design practice and to analyse and critically assess examples of good practice in sustainable and resilient urban design	Ability and skills to apply theoretical concepts in project, to prepare and present design projects and models to quickly and efficiently make design decisions and reflect upon effects in order to improve the quality of the project.

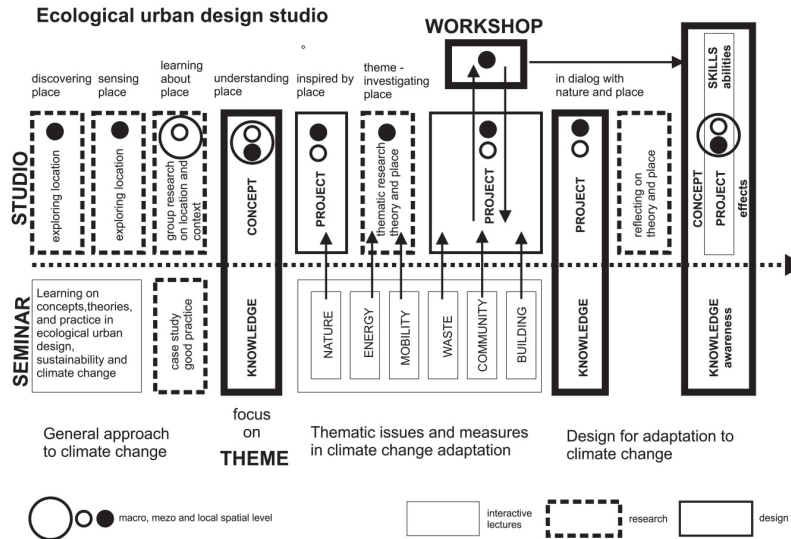


Figure 2. - Studio MO1U - Ecological Urban Design (EUD) Studio: Structure and process
 Awareness and knowledge on *general approaches and issues of climate change* in relation to urban environment are mostly developed through seminar format and in some part through analytical phase of the studio project. Abilities to understand, analyse and relate issues of climate change can also be developed through these two learning formats. *Skills for adapting cities to climate change* can be developed through experiential learning cycles conducted at interrelated studio and workshop formats.

Being part of Master of Architecture program and as such essentially project-based, Study Unit Ecological Urban Design is focused on more *thematic approach to climate change issues* in both seminar, studio and workshop learning formats. As a result of exploratory and analytical phase of working on project, students are asked to define *theme* that will further be explored in particular place and developed through project design. *Climate adaptation issues (flood, overheating, water management/drought)* are leading the choice of *theme* and approaches such as water-sensitive urban design, making place for water, concepts of SUDS, and greenways are often applied. Structure and process of Study Unit EUD make *multiscalar approach to climate change* possible, particularly through seminar and studio format.

Comparative Analysis

The presence and the level of integration of climate issues in the two place-based urban design education models are compared in the Table 4. and further discussed.

Being place-based and place sensitive, and having sustainability and ecological approach at its basis, *both models have the potential of to integrate general climate issues*, both directly and indirectly. Since both curriculums are conceptualised to enable students to analyse, conceptualise and propose spatial interventions at different spatial scales, *complex understanding of problem of adapting cities to climate change and multi-scalar approach to climate issues is possible*.

Table 4. - Integration of climate issues into place-based urban design education models

	Model 1 Sustainable communities studio		Model 2 Ecological design studio		
	studio	seminar	studio	seminar	workshop
General approach to climate change	+	+	+ -	+	-
Thematic approach to climate change (flood, overheating, droughts/water management)	+ -	+ -	+	+	+
Multiscalar approach to climate issues	+	+	+	+	-
Awareness on CC	+ -	+	+	+	-
Knowledge on CC	-	+	+ -	+	-
Skills for ACC	+	-	+	-	+
Abilities for ACC	+ -	+ -	+	+ -	+ -

Different models of studio courses employ different forms and levels of integrating climate issues into learning process. Organised at different levels of architectural education, they differently enable development of awareness, knowledge, skills and abilities in climate resilient urban design. The main task of the Bachelor of architecture course "Sustainable urban communities" is to provide students of architecture with a basic knowledge and skills in urban planning and design, and to relate it to concept of sustainable urban development. Climate change is here introduced as a problem of urban sustainability, and provides students (in a programmed and structured way) with broad and general awareness and knowledge and mostly analytical abilities and skills. On the other hand, Master of architecture course "Ecological urban design" is oriented towards thematic research for (and through) design, and as such enables thematic approach and deepening of knowledge, abilities and skills related to climate change issues. In that sense, location of the course on Bachelor or Master of architecture level function as *constraint*, but it is worth acknowledging that presented courses work as complementary. This can be seen as an opportunity to develop continual and both broad and deep knowledge, awareness and abilities to design in relation to climate change. It is important because climate change, as complex problem, asks for more than one learning cycle for developing necessary professional capabilities.

In addition, comparison of learning formats shows that they have different potentials to integrate climate issues. More general approach and development of knowledge and awareness in relation to climate change is possible on seminars, while thematic approach and development of skills and abilities is provided through studio and workshop formats. Since these different learning formats have different potentials to integrate climate issues and work complementary, it is important to enable students to have continuity in facing and tackling climate problems through different learning formats on different courses.

Conclusions

In order to explore possibilities of integrating climate adaptation issues into urban design, we presented and compared two models of place-based urban design education from Faculty of Architecture University of Belgrade. We showcased that, as a basis for designing climate-proof cities, place-based approach can successfully be operationalised in different ways, and that different teaching and learning models are leading to different forms, levels and intensities of integrating climate issues into learning process. Presented models proved to be complementary, one developing more broad and other more focused and thematic knowledge, abilities and skills in relation to climate adaptation. At the same time, the comparison of studio, seminar and

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workshop learning formats showed their different potentials to integrate climate issues, and that they may function as complementary, too.

These findings suggest that the development of climate-sensitive professional capabilities need and should not be done in one single urban design class or studio, but asks for continual and evolving development of awareness, knowledge, abilities and skills and exploration of different learning and design approaches. In that sense, introducing climate issues through *continual educational cycles* may help in changing the mindset and developing climate sensitivity of students. In order to better tailor climate-proof urban design education for local development contexts, future studies should explore not only other urban design learning models and formats (elective subjects, workshop formats...) and their relationships, but also how are they related to specific local traditions of urban design practice.

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