Building construction education for landscape architects at Cracow University of Technology - virtual and physical modelling workshops

Sabina Kuc

Cracow University of Technology
Kraków, Poland

ABSTRACT: This article explains how virtual and physical modelling workshops influence the building construction education of landscape architects at Cracow University of Technology (CUT) in Kraków, Poland. The building construction programme aims to provide education about the new building materials and technologies using various methods, including virtual and physical modelling workshops. The main overview of the option of teaching new technologies is given in the first part of the article. The second part shows the meaning of virtual and physical modelling workshops in the 3rd-year programme of BA landscape architecture studies. The third part is dedicated to the analysing some examples of projects and their virtual and physical modelling. By analysing the curriculum, the author has endeavoured to show the new approach to landscape architecture studies adopted at CUT.

INTRODUCTION

In the era of global computerisation, the use of more and more advanced computer technologies in various aspects of life necessitates their implementation into universities' educational processes. The introduction of new software concerns both academics and practitioners of different specialities (buildings, interior design and landscape). It now seems impossible to create any architectural design or conduct the education process without applying them. However, the complexity of modern technologies is not always beneficial. Therefore, it is inevitable that physical models [1] be introduced in addition to virtual architectural models in order to teach to students and to show them the importance of preliminary architectural concepts and design intent.

METHODOLOGY OF WORK

For universities' teaching programmes to be up-to-date, constant adjustments and innovations need to be implemented. Education programmes of architectural studies have been subjected to analysis, change and criticism for years. Especially nowadays, it is crucial to compare programmes implemented at different universities focusing on the objectives of the studies, methods and outcomes of teaching. For example, some universities introduced the elements of the investment process into their programmes to help students in their future architectural practice.

Many adjustments have also been made at Cracow University of Technology [2-5]. Among other things, the author created the teaching programme for a *Building Construction* course for landscape architecture studies in the Faculty of Architecture [6]. She has conducted lectures, seminars and design classes in this subject since 2001.

The author has often presented the various steps in the design of the programme and the ways of its implementation. The first presentation entitled *Common building (general building systems) as a part of teaching landscape architects* concerning this topic took place during the *EAAE Prize Competition 2001-2002, Writings in Architectural Education* conference in Copenhagen [7] in 2003 and this encouraged the author's work on the programme. The last paper entitled *Modern technologies and innovations – landscape architecture education at CUT Krakow* was presented in Bratislava at the *4th World Conference on Technology and Engineering Education - Innovative Design and Education*, held at Slovak University of Technology in 2015 [8]. It introduced the principles of teaching this course in the context of other courses including Integrated Design conducted in this field.

In the current article the author discusses physical and virtual models as a part of the teaching programme [6] for a Building Construction course carried out in Semester 5 (winter semester of the third year) of landscape architecture studies in the Faculty of Architecture at Cracow University of Technology. This article was presented at the *8th WIETE Annual Conference on Engineering and Technology Education* held in Bangkok in February 2017.

BUILDING CONSTRUCTION

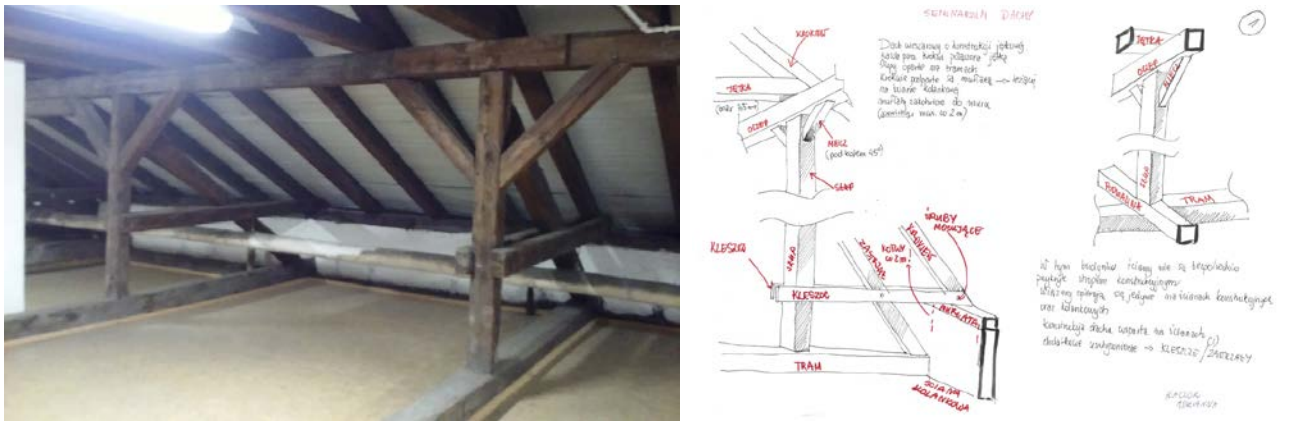
The building construction programme aims to teach students about the newest technologies, but also about older building materials using various educational methods [8]. This part of the article gives an overview of learning options at CUT during the Building Construction course. According to the curriculum, the programme of this course involves the creation of building construction and construction design of a landscape architecture structure [6]. Moreover, those concepts were previously realised by a student as part of the Integrated Design and of the Land Development Project, where the structure is located.

The idea to integrate design and technology courses arose during the creation of the teaching programme for a Landscape Architecture major. Its implementation as part of Integrated Design, Building Construction and Construction courses allows for the incorporation of a real design process into the student training programme (Figure 4) [8-11]. The design process consists of the following stages: pre-design part, architectural concept, building construction design, construction design and detailed design. The concept of the architecture form is developed in Integrated Design classes. The construction and detailed design are created in Building Construction classes.

The importance of physical modelling workshops in the building construction 3rd-year programme of BA landscape architecture studies is extremely significant. The process of creation of the design consists of a series of lectures in the field of building construction and three seminars (Seminar No. 1, Seminar No. 2 and Seminar No. 3). Various teaching methods and ways of conducting classes are used. During the lectures, types and the use of roof structures are presented, among others topics.

The students begin by reviewing the structures of traditional wooden roofs. This knowledge is used to create various landscape architecture structures: arbours, pergolas, viewpoints, etc. This is applied later, and it is the beginning of the process of understanding all the aspects of the construction of the roof. In addition to lectures, the topic is further explored during Seminar No. 1 entitled *Wooden roofs in the building of the Faculty of Architecture at Warszawska Street* (Figure 1a).

During the seminar, students produce hand drawings of a traditional wooden roof of the building in which the seminar is held (Figure 1b) The drawings include plans, sections and axonometric projections of the roof in the final stage. This allows the students to learn about details of roof construction and the existing structure in situ.



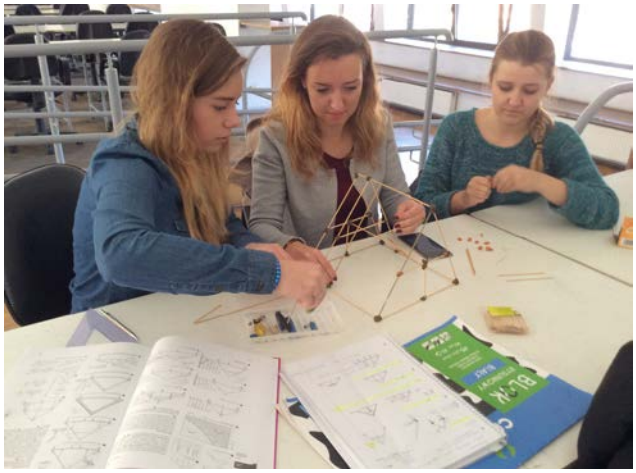
a) b)

Figure 1: Seminar No 1, *Wooden roof on the building of the Faculty of Architecture at Warszawska Street* conducted at the Faculty of Architecture of Cracow University of Technology at Warszawska Street, Kraków, Poland.

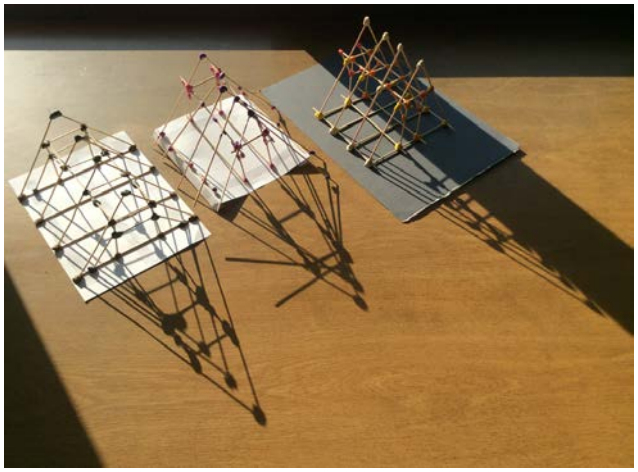
The next activity - Seminar No. 2 entitled *Physical modelling workshops - wooden roof construction* (Figure 2) is focused on the creation of a working physical model of a selected roof structure in class. During Seminar No. 2, each student selects a specific type of roof. The topic is initially developed with the use of academic textbooks or materials found on the Faculty's Web site.

The next step is the manual exercise that involves making a physical model with the use of wooden sticks and plasticine. The plasticine replaces woodwork joints, connecting wooden elements with each other (Figure 2).

This type of exercise allows students to *feel* the opportunities and limitations of the structure and has proved to be a great teaching tool. This allows students to familiarise themselves with design solutions and enables their imagination and creative thinking to develop. This also allows them to initiate next phase, which is the integration of previous drawings and modelled structures into their final architectural project for the Integrated Design course. Above all, this contributes to their abilities in further applications of various roof structures solutions in their future projects.



a)



b)

Figure 2: Seminar No. 2, entitled *Physical modelling workshops - wooden roof construction* at the Faculty of Architecture of Cracow University of Technology, Kraków, Poland.

In the academic year 2016/2017, a new teaching element - *Assel blocks*, was present for conceptual work while creating design solutions (Figure 3). Assel Pazylbekova, a graduate student of architecture at Eurasian National University in Astana, Kazakhstan, in the summer semester of 2015/16 led the research as part of the *Convertible Working Model for the Conceptual Design Process* project at the Institute of Building Construction in the Faculty of Architecture at Cracow University of Technology under the supervision of Professor Sabina Kuc [12]. Ms Pazylbekova also was at the CUT for a two-week graduate internship during the winter semester 2016/2017. The workshops and seminars she participated in showed how important it is to create physical models to conduct the educational process in the field of landscape architecture in the Faculty of Architecture at Cracow University of Technology.

a)

b)

Figure 3 shows Ms Assel Pazylbekova conducting teaching activities in the Faculty of Architecture, Cracow University of Technology, Kraków, Poland.

The following part of this article is dedicated to the analysis of some examples of projects and their virtual and physical modelling. After the lectures and seminars during the Building Construction course and the development of the concepts for architectural designs for the Integrated Design course, the students begin the second part of building construction programme - building design. This section of the programme consists of a series of eight sessions.

The first session is Seminar No. 3, entitled *Physical modelling workshops - construction of a landscape architecture structure*. During this meeting, students create a physical model of their structure's construction with the material of their choice (Figure 4). The goal is for a student to create the physical model, which will imitate the final building. The use of materials ranges from natural, such as wood or stone, to more advanced like steel and new technologies. While developing this model, the students create the construction and materialise structural elements along with the connectors between them. At this design stage, they have to consult with the constructor about their solutions. The comments and changes made by this specialist are extremely helpful in further work. The chain of consultations and re-thinking of the project design prepare the students for the next stage of the project and future work as an independent architect.

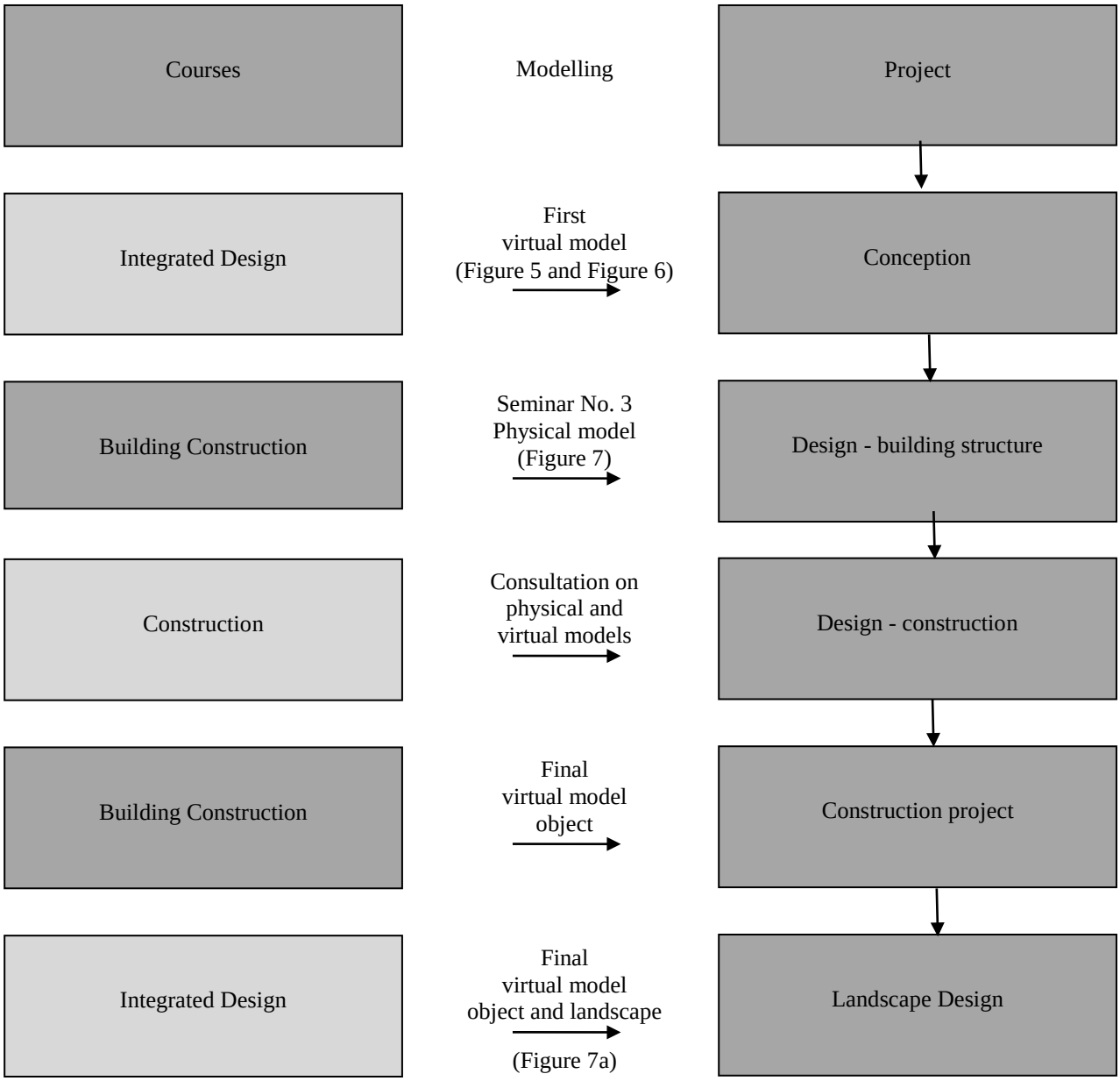
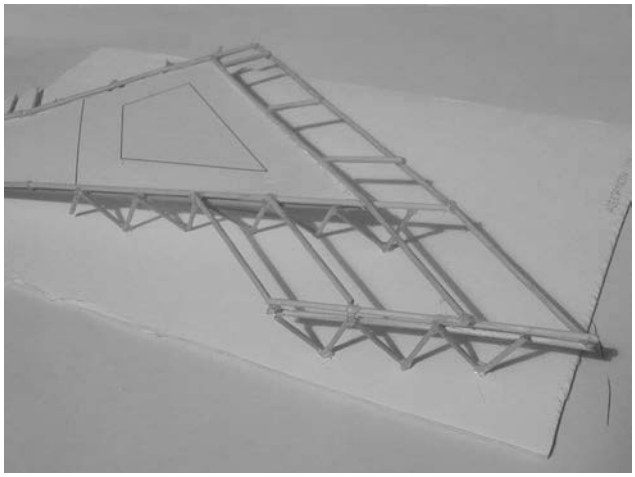


Figure 4: The idea to integrate design (Integrated Design) and technology (Building Construction and Construction) courses, a 3rd-year programme of the BA landscape architecture studies (Faculty of Architecture, Cracow University of Technology, Kraków, Poland).

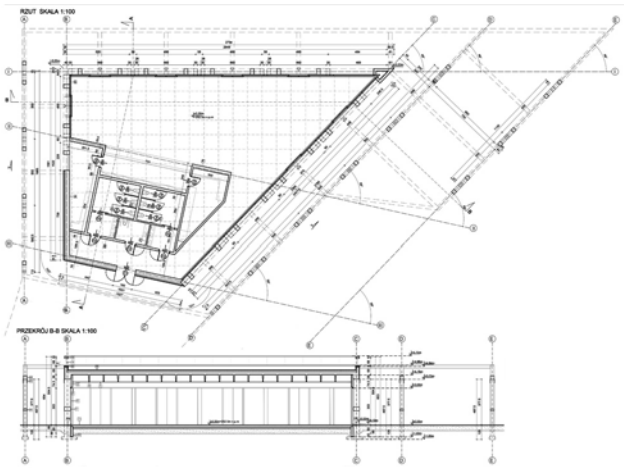
a) b)

Figure 5: First virtual model - *Project of Park Pavilion*, student Katarzyna Micorek, winter semester 2016/17, 3rd-year programme of the BA landscape architecture studies (Faculty of Architecture, Cracow University of Technology, Kraków, Poland).



a) b)

Figure 6: *Project of Park Pavilion*, student Aleksandra Malik, winter semester 2016/17, 3rd-year programme of the BA landscape architecture studies (Faculty of Architecture, Cracow University of Technology, Kraków, Poland); a) first virtual model; b) physical model.



a) b)

Figure 7: *Project of Park Pavilion*, student Aleksandra Malik, winter semester 2016/17, 3rd-year programme of the BA landscape architecture studies (Faculty of Architecture, Cracow University of Technology, Kraków, Poland); a) final virtual model - object and landscape; b) horizontal projection.

Further seminar sessions are focused on the creation of a building design project. Students try to predict the development of a building construction design by creating all parts of the project, including the structure's projections, sections and elevations. After detailing the design of the construction material solutions, it is time for the construction of the next version of the virtual model. The final virtual model shows architectural, structural and material solutions.

In the next stage of the design work (in Integrated Design), students supplement the virtual model of the structure with the surrounding elements, i.e. trees, shrubs, paths and benches (Figure 7a). The first version of the virtual model had been made during the development of the architectural concept in Integrated Design (Figures 6 and 7). All these steps of the building constructions programme give students insight into the process of design and making a project and make a contribution to the process of education of new landscape architects.

CONCLUSIONS

The aim of this article was to present a novel approach to the study of landscape architecture at Cracow University of Technology by providing an insight into the curriculum. The new teaching strategy used at CUT, when educating future landscape architects consists of the introduction of technical subjects into the curriculum and the adoption of an integrated approach to teaching. The multiple technical subjects are incorporated in an interdisciplinary Integrated Design course (Figure 4) [8].

An essential element of the whole programme is the series of seminars mentioned above, during which students make physical models of the construction: either a part of the building (e.g. a roof) or the whole landscape architecture

structure (according to their architectural concept). These models make the previously developed concept (preliminary virtual model) more detailed; they help create a structural construction vision and become a guideline for the implementation of an eventual virtual model. The students develop creative thinking, space awareness and idea/design process. This programme provides the students with the opportunity to develop skills and knowledge about the roof and building constructions that they can further implement in their future works.

Cooperation between the Integrated Design, Building and Building Construction courses is the most important feature of the curriculum for the subject of Building in the field of landscape architecture in the Faculty of Architecture at Cracow University of Technology. In pursuing the realisation of those main programme assumptions, the virtual and physical modelling workshops play a most important role.

REFERENCES

1. Kusionowicz, T., The use of models in teaching *General Building Engineering* to architects. *Global J. of Engng. Educ.*, 18, **3**, 196-201 (2016).
2. Böhm, A., Kształcenie architektów krajobrazu w Polsce - osiągnięcia i niedostatki (Education of landscape architects in Poland - achievement and defects). *Krajobrazy Dziedzictwa Narodowego*, 1, 37-39, (2000) (in Polish).
3. Böhm, A., Professional Prospects of Landscape Architects in Poland. *III Forum of Landscape Architecture, New Ideas and Development in Landscape Architecture in Poland*, Warszawa, Poland, 334-337 (2000) (in Polish).
4. Kosiński, W., ABC of Landscape Architecture for *Absolute Beginners. III Forum of Landscape Architecture, New Ideas and Development in Landscape Architecture in Poland*, Warszawa, Poland, 40-43 (2000) (in Polish).
5. Zachariasz, A., Early development of the profession of landscape architect. *III Forum of Landscape Architecture, New Ideas and Development in Landscape Architecture in Poland*, Warszawa, 324-333 (2000) (in Polish).
6. Kuc, S., Teaching Programme for the Subject *General Building Systems for Curriculum Landscape Architecture*. Faculty of Architecture, Cracow University of Technology (Program nauczania przedmiotu Budownictwo Ogólne dla Kierunku Architektura Krajobrazu na Wydziale Architektury Politechniki Krakowskiej), Kraków, Poland, taped (2000) (in Polish).
7. Kuc, S., Common building (General building systems) as a part of teaching landscape architects. *EAAE Prize Competition 2001-2002, Writings in Architectural Education*, Royal Danish Academy of Fine Arts, Copenhagen, Denmark, 1 June 2003, www.EAAE.be/prize
8. Kuc, S., Modern technologies and innovations - landscape architecture education at Cracow University of Technology in Kraków, Poland. *World Trans. on Engng. and Technol. Educ.*, 13, **3**, 307-311 (2015).
9. Büttner, O. and Kuc, S., Exemplary results of close cooperation between architects and structural engineers. *VIIth All-Polish Scientific and Technical Conf., Problems of Designing and New Building Technologies*, PAN O/Kraków i ZBO Wydział Architektury PK, Kraków, Czasopismo Techniczne PK, z.4-A/2007, 3-8 (2007).
10. Kuc, S., The new building technology at the landscape architect's work. *Vth All-Polish Scientific and Technical Conf., Problems of Designing and New Building Technologies*, PAN O/Kraków i ZBO Wydział Architektury PK, Kraków, Poland, 24 October (2003) (in Polish).
11. Kuc, S. and Piebiak, I., The building technology at landscape architect's education (2004), *EAAE Prize Competition 2003-2005, Writings in Architectural Education. Research and Results from Research and\or New Ideas Implemented in Architectural Education*, EAEA workshop in Copenhagen, 25 November 2004), www.EAAE.be/prize
12. Pazylbekova, A., Transformed architectural sketch modelling to improve conceptual design skills. *Global J. of Engng. Educ.*, 18, **3**, 207-212 (2016).