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**The New Teaching Methods  
of Contemporary Construction Teaching**

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Constant changes of political, economic and social matters cause also great modifications in building industry and investment process. In such situation the architectural education should equip the future architect with the competence and skills necessary to understand actual professional reality and adapt oneself to changing circumstances. Adapting of the content of curricula and teaching methods seems to be a constant preoccupation of most of the teachers within the architectural education area. Adaptation concerns two areas: one - changing and developing of essential content and second – improving the teaching methods by utilizing modern tools (software, databases, websites etc.)

All improvements and modifications in education follow or happen parallel to those in external professional world. In case of architectural education it replies to occurrences in architectural design area and its adaptation to new possibilities of presentation. In digital era we use all contemporary equipment as obvious useful tools despite a psychological resistance appearing in some cases. Architects of older generation remember introducing rapidograph as a new tool for technical drawings and resistance to it from conservative designers who maintained the opinion that previous tools like graphion and graphos had given sharper and uniform line. But technological progress cannot be restrained and criticism caused only improvements in the new tools, not retreat. The same happens nowadays in the area of computer equipment connected with designing. Both hardware and software constantly change making work easier and quicker and results very effective. But all of that concern preparation and presentation aspect. Design in its essence being an intellectual and artistic act of creation is unchanging whatever tool is used for its presentation. In all times good or bad result depended on talent and knowledge of the designer. In some respect facility given by modern equipment may cause even the danger of design quality decrease by using uniform solutions and details.

The changing conditions of real life influence all modules of architectural education: architectural and town planning design studios, construction and structure units, even historical subjects. Exchange of experiences and close cooperation between teaching units within the school system is very important though not always work well due to organizational division to many separate units as it is in our school. Also amount of work within the units connected with number of students and necessary concentration on own subject prevent frequent working contacts between members of different educational divisions.

## **Architectural Design Studio**

Looking at students' architectural concept designs prepared in an architectural design studio one can see that in most cases they imitate examples of contemporary architecture following its external forms and trendy material solutions. Students have easy access to all information concerning examples of modern architecture through the Internet, looking at illustrations in professional magazines, sometimes reading text. Having this as a basis of information students usually imitates an external view of architectural objects. Using computer they may achieve in their work very attractive form shown at coloured elevations and visualisations. Effective vision is not always connected with high quality architecture if it does not correspond with proper func-

tional and technical solutions. But there is also a positive aspect of such presentations. Computer demands decisions concerning colour, facture, and size of elevation units and in this case students are forced to think about real materials.

Visiting real buildings would be the best way of becoming acquainted with a wide spectrum of aspects like scale, feeling of space, relation with surrounding objects, materiality, details seen in close distance and checking in reality the functional solutions. Imagination developed on the basis of pictures can be false in comparison with reality. I experienced such situation visiting with students the Piazza d'Italia in New Orleans. Knowing this object from coloured photos in magazines and books, shown there without any people on the picture (scale), I found it much smaller than I imagined. Also used materials and details looked differently, simpler than on pictures.

Travelling is much easier nowadays but the time aspect is crucial, so still the simplest way to observe happenings in modern architecture is by looking at pictures either in printed way or through Internet. Even if the presentations of architecture incorporate analytical comments and technical details, students mostly notice the visual effects from pictures. Rational analysis of the interrelation of functional and technical contents in existing objects and the visual and spatial results arising from it are very rare. Such analysis of existing buildings would introduce rationalizing at the stage of an architectural concept decisions. Rational decisions cause that architectural concepts are more real and will not be much changed at the stage of further structural and constructional development, it means, the final view of realized object would be very close to the original concept.

## **Construction Teaching**

In case of Construction, we, teachers of this field have to observe and follow all modifications in building technologies and incorporate new information appropriately to the existing educational curricula. Along the changes and development of knowledge content also the means of communication, presentations and design preparation, which are more effective due to electronic digital aides, should be modified. Both these aspects affect the aims and objectives of the already established modules and courses.

In the past the number of construction materials and building technologies was limited, thus the lectures and exercises at school and students' hand books were sufficient sources of necessary knowledge. The changes were very slow and technical solutions and constructional details learned at school could have been used in the professional life for some years after finishing study. Nowadays because of the enormous amount of new materials, technological details, complex infrastructure and services and also fast changes and improvements in technologies, there is no sufficient time to cover this wide spectrum of information within the school course. Especially fast changes and modifications have to be taken into consideration, as students will start their self-dependent professional life some years after their construction course in already modified technological reality. In this respect we should give them the basic knowledge and the method of finding current information, analyzing obtained particulars and adapting them to the actual needs.

Being aware that students have now ample opportunity to get information eas-

ily via the internet, from technical literature (now usually at CDs) and by contacts with manufacturers, we may reduce the amount of detailed technical information and put stress on basic information and unchangeable rules. This would help to explain how the building works as a complex object where elements of structure, physical performances, functional arrangements, and visual effects are combined in one system. This basic knowledge would be a sort of guideline for students helping them to use the external sources of information in rational and purposeful way. While teaching this essential knowledge we may and in fact we must use all modern aids like computer presentations and animations so that we can communicate with students using tools to which they are accustomed. Young people use a computer from early years treating it as a natural tool. It is very easy for them to improve their skill learning at architectural school how to use the CAD programs to prepare presentations of their work such as 2D and 3D working drawings, visualizations, combined presentations etc. During the lectures illustrations supporting the speech should be attractive in form of coloured pictures, animations short films, etc. The practice proved, though, that carefully prepared presentation delivered in mechanical way might after some time put students' attention and comprehension to sleep. Generally the speaker feels the level of perception within the audience. To check it some control questions may be also asked. Very often it is necessary to return to some points and to clarify them returning to traditional method and using blackboard to make sketches, graphs etc. while speaking.

In teaching and learning such subjects like building mechanics, structures and building physics, calculations were substantial part of students' exercises. Nowadays teachers give to students appropriate calculation programs. In this situation calculation itself takes less time so more time can be spent for essential problems of technical design such as general concept, settling the initial data and valuation of results in aspect of expected architectural form.

The areas of structural mechanics, structures, mechanical and electrical services are essential for architectural students in view of future professional practice but rather for effective cooperation with engineers of these specialities. Technical architectural design, working drawings, construction details prepared in professional practice by architects themselves are closely connected with content of construction teaching and with rules of building physics. This division has a reflection in our school in organization of teaching units.

Studio for Building Materials and Construction Technology and Studio for Building Physics and Services are parts of the united Division for Technical Basis of Architectural Design.

As a member of the Studio for Building Materials and Construction Technology I will present a content of construction teaching in our unit and ways of dissemination of appropriate information to students.

When developing the program of Construction course the use of computer both at teachers and students sides must be taken into consideration. Digital aides are very helpful and effective but also bring some dangers. Because of easy access to suitable sources, the students' works consisting of construction details seem to be per-

<b>subject</b>	<b>school unit</b>	<b>teachers</b>
Structural Mechanics: Reactions and inner forces in several structural elements	Division for Mechanics of Structure	Structure engineers
Structures (design and basic calculations – timber, masonry, concrete, steel), Structural design	Division for Structural Design	Mainly Structure engineers, architects
Building Physics Building Services Utilities and Urban Infrastructure	Studio for Building Physics and Services	Service engineers (researcher/theoretician, and practitioners)
Building Regulations Cost calculations Investment Process Organisation	Division for Building Economy	Architects
Construction Technology and Materials, Technical design: working drawings, construction details	Studio for Building Materials and Construction Technology	Architects
Elements of Mathematics and Descriptive Geometry	External University Unit	Mathematicians (for Descriptive Geometry cooperation of an architect would be advantageous)

Table 1. Area of technical knowledge and building economics

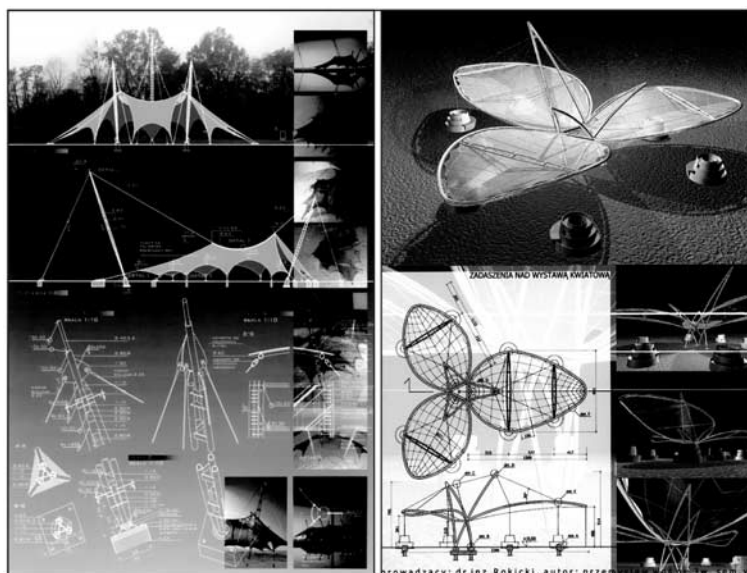


Fig. 1.  
Examples of  
Structural  
Design

<b>year / semester</b>	<b>content</b>	<b>type of didactic action</b>	<b>hours per semester</b>
I / 1	Students analyze the construction elements of a small scale building from the foundation to the roof considering various materials and systems, concluding with the preparation of construction documents detailing their understanding	<i>lecture</i>	15
I / 2		<i>exercise</i>	30
II / 3	Finishing details and more advanced building systems such as curtain walls, external cladding	<i>lecture</i>	15
II / 4	Preparation of documentation booklet containing drawings and specifications similar to those submitted when applying for a building permit; the building is based on the concept deriving from the architectural design studio done in the previous semester. This semester concludes with a practical examination demonstrating students' ability to make and document technical decisions.	<i>exercise</i>	30
		<i>exam</i>	15
	Two weeks practice at a building site		summer brake
III / 8	Elective lecture concerning contemporary construction technologies	<i>lecture</i>	15
III / 5, 6 IV / 7, 8	Construction teachers take part in the design studio and first stage (bachelor) diploma design	<i>consultations</i>	24
Master degree stage			
I / 1	Elective seminar concerning development of architectural details.	<i>seminar</i>	30
II / 3	Contemporary construction technologies	<i>lecture</i>	15
		<i>seminar</i>	15
I / 1,2 II / 3,4	Construction teachers take part in the design studio and Master degree diploma design	<i>consultations</i>	24
			24

Table2. Studio for Building Materials and Construction Technology



fect. In fact they are often traced drawings straight from manufactures' digital libraries or from catalogues with no connection to the actually designed building's construction and with no imagination of spatial arrangement. In this case developing of working details should include a form of primary hand made sketches and subsequent to it final details, both in axonometric view. Sketches are very instructive tools for conscious creation of construction details where the technical solution and visual effect are instantly visible. Final drawings prove that attempted vision is satisfactorily achieved.

In Construction teaching stressing the interdependence between material and technological solution and architectural form is important. Starting from the simplest detail drawings done at the beginning of the course, students have to be aware that every line at their drawing causes spatial, visual effect. Also analyzing existing building elements and transferring it to the form of the working drawings is very instructive.

### **Interrelation between Construction teaching and Design Studio**

The basic part of knowledge should be introduced to students as early as possible within the program curriculum. It may help them in rational developing the concept design in the architectural studio. At the later part of the course when students are more experienced in architectural concept design and they hopefully still remember basics from Construction primary course, the introduction of more advanced and complex technological solutions is possible. In our school at this stage we introduced a series of lectures relating to modern technologies often with participation of the manufacturers' representatives. Another activity is an optional seminar dedicated to formation of an architectural detail in two aspects: - formal, considering proportions, colour, facture and - technological showing materials and technical solutions undertaken to achieve the assumed visual effect. Students at this seminar work in two stages. First they analyze details of existing buildings and investigate modern technological possibilities and second they prepare their own proposal of the detail - possibly as part of their design done at the architectural design studio.

Another example of integration of technical attitude and visual effect is the Structural Design prepared by students for termination of structural course. Again students have the opportunity of showing their abilities in both - technical knowledge and developing of architectural form. The objective of this task is to design an architectural object in which the structural part is dominant and has an impact on architectural form. Students are choosing one of such objects like exhibition pavilion, sport hall, footbridge, entrance canopy, observation tower. Preparation of the design includes dimensioning of structure (calculation), drawing of whole structure and chosen details, 3-D view of the object in form of physical model or computer visualization.

The concept design of single family house done in an architectural design studio in the third semester is a basis to students work in later semesters during courses of Construction, Internal Installations and Building Economics. Construction course in the fourth semester consist of preparation of documentation booklet containing drawings and specifications similar to those submitted when applying for work permit of the building based on above mentioned concept design. Students have to analyze



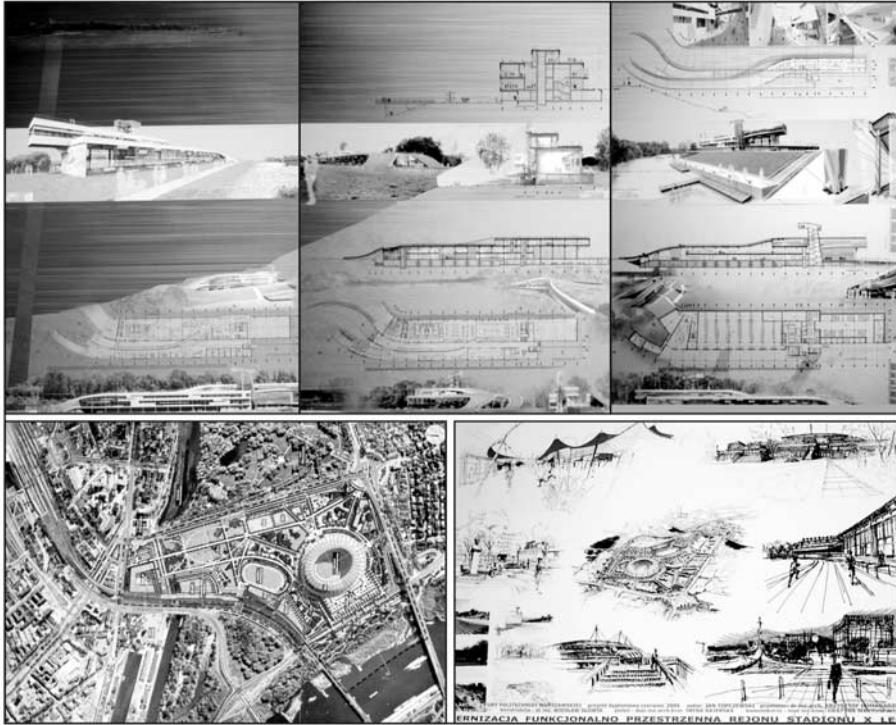


Fig. 5. Presentations of diploma architectural designs

Working together, architectural design and construction teachers, within the design studio would be very effective. It would resemble real design office where school type divisions do not exist and specialists work in one team. Previous attempts undertaken in our school were not successful. It was caused partly because of lack of interest from some design teachers but mostly because of organisational difficulty. Division to separate units and especially sharing limited didactic time was a problem. In the new proposal of program curriculum, special time for technical consultation within the architectural studio was provided. The teachers of Construction, Structures, Building Physics, Services suppose to take part in design classes giving necessary advise in provided and secured time. Organizational problems suppose to be settled, but previous trials of such arrangement showed also essential didactic difficulty. Most of students working on their concepts were not ready to discuss technical problems up to the end of the term. Design teacher should settle appropriate time schedule to improve cooperation and take advantage of structure and construction specialists' help. May be this time we will work out satisfactory arrangement.

More successful are the consultations given during the diploma design. Diploma students are more aware of the importance of the reality at the designing and they keenly take opportunity of an access to any information, which can improve their work. Architectural idea, formal and functional arrangement are vital parts of their work, but they have to determine structural and materials solutions. They are also required to show an individual architectural detail and its technical and material solution characteristic for the designed object.