

INNOVATIVE TECHNOLOGIES IN ARCHITECTURE AND DESIGN ACTIVITIES AS AN "EDUCATION-SCIENCE-PRODUCTION" SYSTEM

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Abstract: The article aims to reveal innovative methods to develop imaginative thinking in future architects-designers, their imagination, without which it is impossible to create something new, as well as methods of forming critical thinking. The indicated above forms the worldview of young people. It gives them an understanding of themselves and the search for their place globally, significantly when these issues are exacerbated in crisis periods, such as the present time. The research explores problematic aspects in the formation of knowledge and competencies of future architects and architect-designers. Today, the issue of training professional architect-designers in the specialty "191: Architecture and Urban Planning" of the educational program "Architecture of Buildings and Structures" and "Design of Architectural Environment" is becoming critical.

Keywords: Architectural education, Architecture and design activities, Creation of the architectural environment, Future architects-designers, Innovative technologies, Teaching methods, Training of professionals.

1 Introduction

Education programs in architecture and design activities must correspond to dynamic changes in society in matters of state reconstruction in connection with the aggression of Russia, which has unleashed a war on the territory of Ukraine and is destroying cities and towns, infrastructure, and linear networks. Against the backdrop of the war in Ukraine, future architects-designers must professionally face challenges in the world's globalized field: quickly respond to social, economic, manufactured, energy-efficient, and other global problems of society from the point of view of their priority.

The problems mentioned above do not remove general societal issues from the architect-designer-professional in his responsibility for forming a safe architectural environment based on sustainable development [26].

Therefore, students should acquire the ability to identify problems and analytically approach their solution [5], and at the same time, take into account issues of a humanitarian nature (with high technological processes), namely:

- Think imaginatively in the categories of general culture and ethnocultural values.
- Possess critical thinking to reflect on understanding oneself as a professional and one's place in the world.
- Have communication skills.
- Develop emotional intelligence and technical skills (with the help of disciplines collectively known as STEM/CS).

All this contributes to the formation of a worldview and the general character of a person. Therefore, students should have the sense to pursue and understand the values of their activity and their responsibility for it, to learn continuously throughout their lives because this is a new reality for the average office worker of the 21st century due to the development of technologies and innovations, as predicts the World Economic Forum (WEF).

These tasks, to one degree or another, coincide with the general criteria of today's leading architect-designers of the world regarding the competencies of an architect-designer, a graduate of a university [13]:

- A high level of erudition and interdisciplinary thinking – the ability to analyze and synthesize extensive scientific research with the identification of priority problems of the architectural environment, both general and specific;
- The ability to think creatively and optimally solve identified problems;
- Quick response to dynamic changes in society, in the construction industry, in the world;
- Effective and fast use of RAM, as well as agreed knowledge of a universal nature;
- Operation of imagery and metaphor as tools of high design in shaping the aesthetics of the architectural environment;
- Effective use of graphic language, both applied and computer-based.

These theses emphasize the broad general erudition of architect-designers (leading construction professionals), which has been accumulated over the years.

2 Literature Review

In the framework of a higher school, in addition to the accumulation of technical knowledge, the development of imaginative thinking of students, the product of their imagination, critical thinking, the formation of the worldview of a student-architect-designer as a designer of our future, is the most important goal [12]. All these issues increase the responsibility of teachers to activate the educational process in the "education-science-production" system, using innovative technologies in architecture and design education as a basis for future activities.

It is not the presentation of individual scientific facts that becomes relevant, but their interpretation in cause-and-effect relationships and connections through the active resolution of crises and problems [25]. Therefore, education should be directed to intellectual development, which leads to the mutually agreed formation of professional, both essential, fundamental, and applied foundations of architectural education [14]. Consequently, it recreates a role of a scientific component and acts as a base for human development.

Education, especially in architecture, has always been a strategic resource for the evolution of civilization, which progresses only when education progresses [23]. Today, the traditional system of architectural education in Ukraine, as a system of training a specialist with structural-spatial thinking, requires modernization and new training methods and techniques in connection with the change and development of civilizational processes. This is also the rapid development of computer and information technologies: generative design, methods of parametric design, a network organization of project culture, etc., as well as the issue of the general transition to distance learning – online teaching related to COVID-19, the period of which, continues for the fourth year, and is getting worse in connection with Russia's aggression.

And if the first problem is solved by the modernization of information [4] and computer systems and students' assimilation of new software products [10], then the second problem is more complicated. It can be considered from several positions: on the one hand, the methods remain traditional; on the other hand, such an innovative education model as interactivity has been developed in a few years [13]. In education, its use involves (i) modeling life situations in which the student consciously and professionally participates; (ii) the use of role-playing games; (iii) joint problem-solving.

From the object of influence, the student becomes the subject of interaction [7]. He actively participates in the learning process, following his route. The term "interactive" means a particular form of organizing cognitive and productive activity. It suggests

specific and predictable goals. One of these goals is to create comfortable learning conditions in which the student feels his success and intellectual ability, making the learning process productive.

Several pedagogical models of the organization of architectural education, such as passive (the role of the "object" of learning (listens, watches, repeats), active (acting as the "subject" of knowledge (independent work, creative tasks), and interactive) [29]. The last one is chosen as a system of interactions: "architect-designer-moderator — student-architect-designer — students of the group." Interactive learning technologies are based on a personal-activity approach. They include non-situational (dialogue) and situational teaching methods (interactive gaming methods — simulation, non-simulation; non-gaming interactive methods — analysis and modeling of project situations, etc.)

During interactive learning, there is mutual learning (collective, group, cooperative learning), where the student, the teacher, and the group of students are equal subjects of education. During interactive training, the teacher, a consultant, organizes the learning process. The main thing in the learning process is the interaction between students and the teacher — cooperation between participants. Learning outcomes are achieved through the mutual efforts of participants in the learning process; students take responsibility for learning outcomes [19].

In the process of communication, students learn to solve complex problems based on the analysis of source data; identify contradictions; express alternative opinions; make balanced decisions; participate in discussions; simulate different social situations; enrich their social experience through inclusion in different life situations and experience them; learn to build constructive relationships in the group and determine one's place in it; learn to avoid conflicts or resolve them; seek compromises; strive for dialogue; find a joint solution to the problem; to develop the skills of project activity; to work independently; perform creative works [21].

3 Materials and Methods

Group educational activities in the interactive field of architectural education have shown their effectiveness this year. Therefore, we can consider the means and methods that, in our opinion, were revealed above and are aimed, first of all, at the development of imaginative thinking, imagination, the student's understanding of himself as such, and finding his place in the world, and secondly, the formation of highly cultured professional project activity.

The system "architect-designer-moderator — student-architect-designer — students of the group" was tested at the Department of Architecture of Buildings and Structures and Architectural Environment Design in Educational and Scientific Institute of "Architecture, Design and Fine Art" of O. M. Beketov National University of Urban Economy in Kharkiv on the 3rd, 4th, 5th and 6th courses in such disciplines as architectural design, basics of architectural environment design, basics of scientific research, media architecture and parametric design, complex architectural design, presentation of an architectural project.

These interconnected disciplines lead to the "education-science-production" system because architectural design and urban planning are based on the actual place of design, the definition of its fundamental problems, and their solution in architectural-urban-planning, architectural-design projects presented below.

Thus, in the 3rd year, several classes were held on the discipline "Fundamentals of architectural environment design" when a large-scale invasion of the aggressor took place on the territory of sovereign Ukraine. Some students were forced to change their place of residence. All of Ukraine came under enemy fire.

In these conditions, it was necessary to calm the students psychologically [27] and not lose the high level of their professional training. Therefore, the following tasks were proposed that used interactive methods, such as transmitting information using a lecture-discussion (Figure 1).



Fine art in the natural world - Fashion inspires from all sources. However, the synergy between fashion designers and architects is unparalleled. Architecture makes gifted art, while fashion gives us the art of wearing.



Figure 1 – Architecture and fashion (examples of slides from the presentation)

This lecture was followed by a practical session on the topic "How architecture inspires fashion, and fashion inspires

architecture." A certain task for Student Project was set (Figure 2).

DESIGN OF ARCHITECTURAL ENVIRONMENT AS A SPECIAL FORM OF PROJECT ACTIVITY PRACTICUM

TASK 1. IMAGINARY INTERPRETATION OF ARCHITECTURAL OBJECTS AND FASHION

Goal: To develop a project, "Fashion design as derivative architecture that will emphasize my individuality"

Tasks:

1. View the file "Fashion and architecture.pdf," online resources:
<https://design-mate.ru/read/an-experience/fashion-and-architecture>
<https://design-mate.ru/read/clothes-of-the-future>

<https://www.clouty.ru/articles/pochemu-moda-i-arkhitektura-kopiruyut-drug-druha>

2. View (optionally) architectural masterpieces of all times and peoples and choose an architectural object (or style, detail, or interior) that figuratively belongs to your "I."
3. Analyze (briefly) why the chosen architecture appeals to you or expresses you; what are your "I" features, and how are they reflected in it?
4. Develop a concept form-model of a costume (in a broad sense: dress, overalls, hat, bag - fashion) for yourself.

The object of research: "I" – as individuality

Subject: searching for one's individual "I" through a design project integrating fashion and architecture

Execution: any 2D, 3D execution method is chosen

1. On A3 sheets, develop a fashion model for yourself through the perception of an architectural structure or architectural environment.
2. Present your design project briefly (up to two pages) on A4, in Times New Roman, 14 font, 2x2x2 margins, 1.5 spacing.

*** - you can present the project in PowerPoint.

Figure 2 – Task 1 was aimed at relieving stress and professional analysis of architectural and model masterpieces [27]

Student Project was based on the following methods:

- A. Interiorization (from the Latin interior – internal) is a psychological concept that means the formation of mental actions and the inner plane of consciousness through the individual's assimilation of external activities with objects and social forms of communication;
- B. Exteriorization (from the Latin exterior – external) is a process that is the opposite of interiorization, meaning a transition from the inside to the outside; a psychological concept that represents the transition of actions from an internal and collapsed form to the form of an expanded action. Examples of exteriorization: objectifying our ideas; creating an object according to a previously developed plan [6, 22, 30].

4 Results and Discussion

Most students chose graphics and layout and wrote an essay about themselves. The technique of "Looking at oneself from the outside" forms critical thinking and gives a person a better understanding of himself and the world around him. When a person writes about himself, how he sees himself or feels, connecting himself with his image through clothing based on architecture, he is also thinking interdisciplinary. The individuality needs to immerse himself in world architecture, see herself in it (identify her image with objects), analyze herself as a consumer and researcher, and act as a designer in search of the individual "I." The students' projects are confirmed by scientific research on these issues (Figures 3, 4, 5, 6, 7, 8, 9, 10, 11, 12).



Figure 3 – General self-presentation: the effect of "estrangement" (according to Shklovsky)

According to Shklovsky, "estrangement" (elimination) is the "extraction of a thing from automatic perception," which is considered a specific technique of literary and artistic creativity; in the terminology of one of the leaders of the formalist school, was defined as "reception" [24]. Shklovsky wrote that "the purpose of art is to give the feeling of a thing as vision, not as recognition." A work of art allows one to perceive reality immediately, beyond usual ideas and generally accepted

stereotypes. The freshness and expressiveness of the contact with reality are felt as a consequence of the objectivity of the material and the explicitness of the method of its transformation into a work of art. Shklovsky believed that "art is a way to experience the making of a thing." As examples of this theory, literary material was used: the prose of Tolstoy, Gogol, and Knut Hamsun, as well as Ukrainian folklore [9].

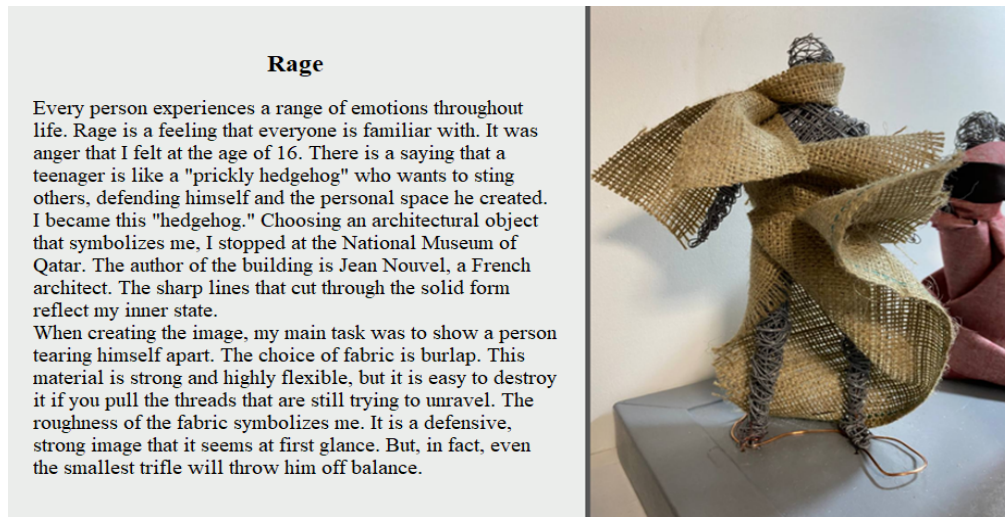


Figure 4 –The "reflection" method. The student contemplates herself from the past, looking for reviews of herself in architecture

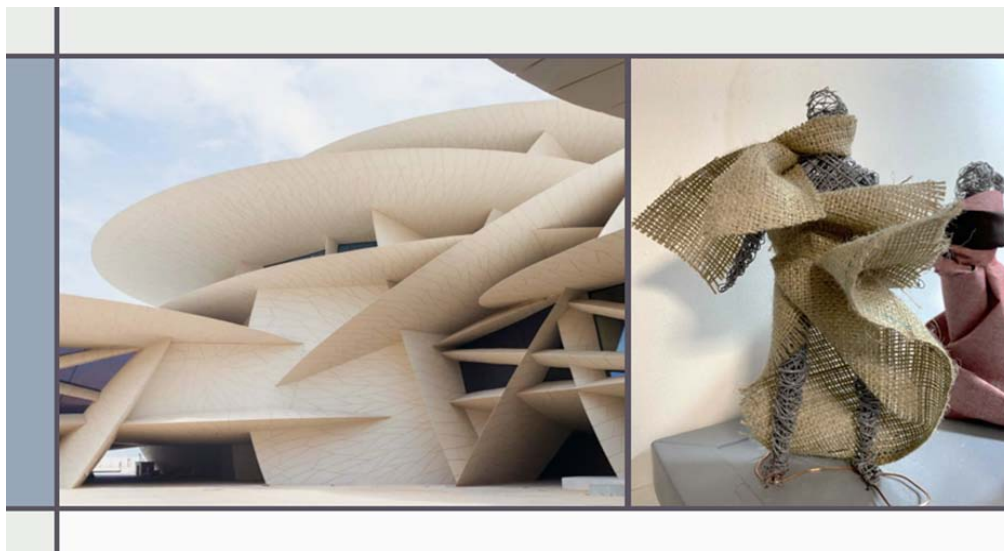


Figure 5 –The method of "identification." The student associates herself at 16 with Nouvel's architectural structure



Figure 6 –The image of "Rage"

In this context, what Nouvel himself says about his creation and architectural creativity becomes interesting: "I always wanted a whole neighborhood rather than a single building. So I started with interconnected blocks of different sizes, inspired by the

white Arab cities (the word medina). This concept provided the necessary plasticity, but I still did not have complete freedom; I determined some changes, and the situation and partners determined others. This is not architecture for architecture's

sake; architecture should be connected with ideas, with the spirit of the place" [16].

Architect-designers increasingly face the problem: developers choose one architect-designer to create the building itself, and another for the interior design. I proposed a palace concept with characteristic proportions and materials that evolve with its contents. In addition, the customer and the team of curators, and I thought very actively and in detail about how to enrich this project with a scientific and cultural program [16].

As the architect-designer himself told in an interview with The Art Newspaper in his Paris workshop, even though today the museum is surrounded by a modern urban landscape, it is still influenced by the desert and the sea.

This served as a source of inspiration for Nouvel, who based his design on the image of the "desert rose," which resembles a

flower with a crystalline structure, which he considers "the most powerful symbol of the desert and the influence of wind, time and sand." He is intrigued by the mysterious shape of the crystal: "Why do these blade-like petals overlap each other so chaotically?" [17, 18].

There is an exciting point in our perception of this work: the contrasts of the desert and the sea are reflected in the power of the "desert rose" flower, which resists their influence with its fragile petals.

This gave rise to Nouvel's image of a museum, both its external and internal architecture and design. The current student analyzes her sixteen-year-old self as a raging girl who opposes the world (parents, etc.), identifying herself as a "prickly hedgehog." Both the spines of the hedgehog and the sharp edges of the museum are similar in a figurative sense.

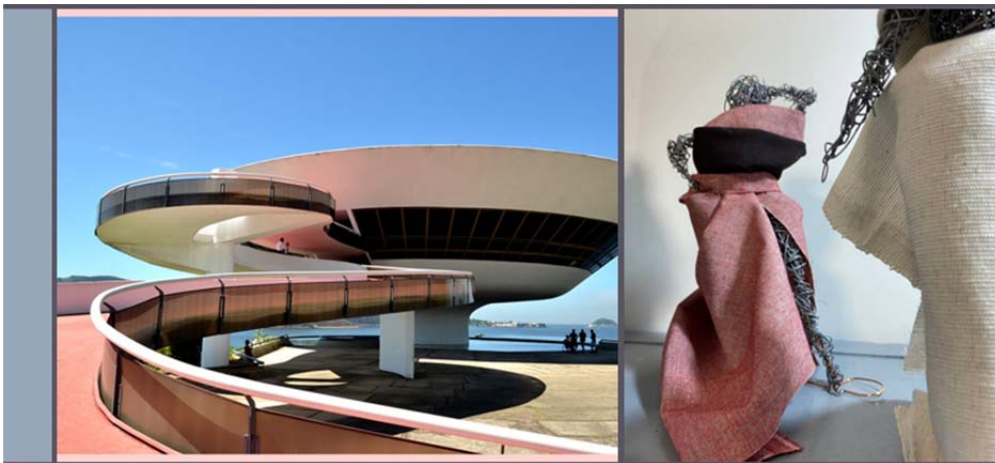


Figure 7 – The search for self and balance. "Criticism," "game," and "discussion" methods

The student writes: "Pink fabric immediately attracts attention and stands out. Calm but simultaneously, dynamic folds repeat the road designed by Oskar Niemeyer in his project. A specially opened leg became the main accent in the image. This frankness

seems to be playing with others. When this feeling goes beyond the scope and becomes the main thing, something needs to be changed."

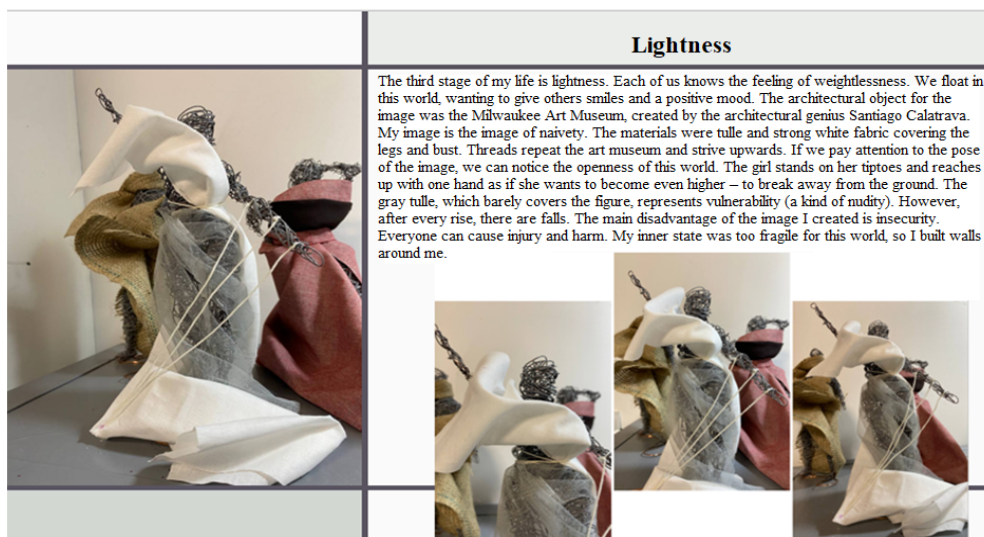


Figure 8 – The third stage of life is lightness. The girl realizes her femininity in the past in today's self-evaluation. She opens the world of attractiveness and feminine charm. The "ugly duckling becomes a swan" approach



Figure 9 – The image of the Milwaukee Art Museum, created by the architectural genius Santiago Calatrava, resembles a bird

Suppose the previous image of the student is characterized as an image of naivety, not yet realized feelings, as a manifestation of something new, not yet recognized.

In that case, the following image is a manifestation of herself as a whole person, a self-confident woman. This stage is called "Confidence" (Figures 10, 11).

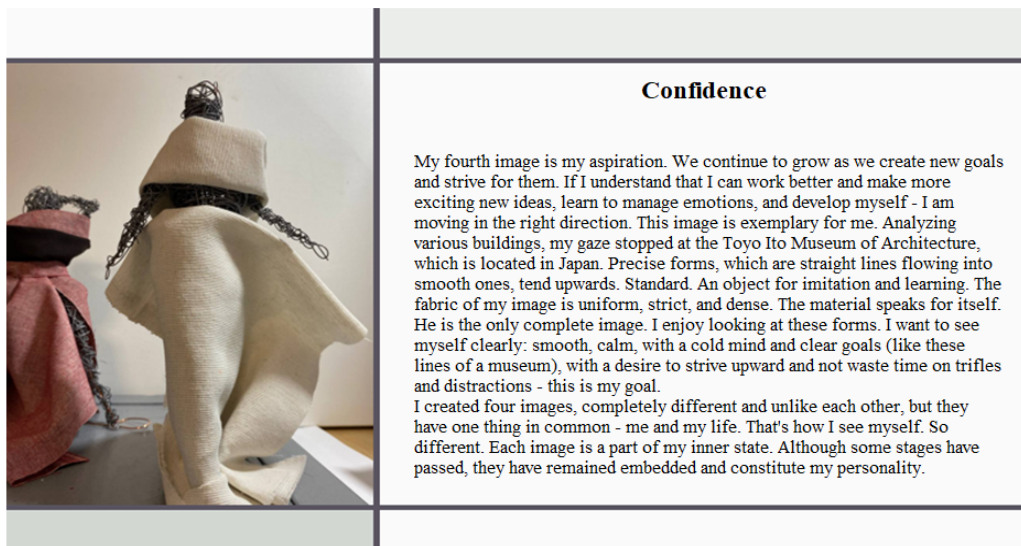


Figure 10 – Image "Confidence"

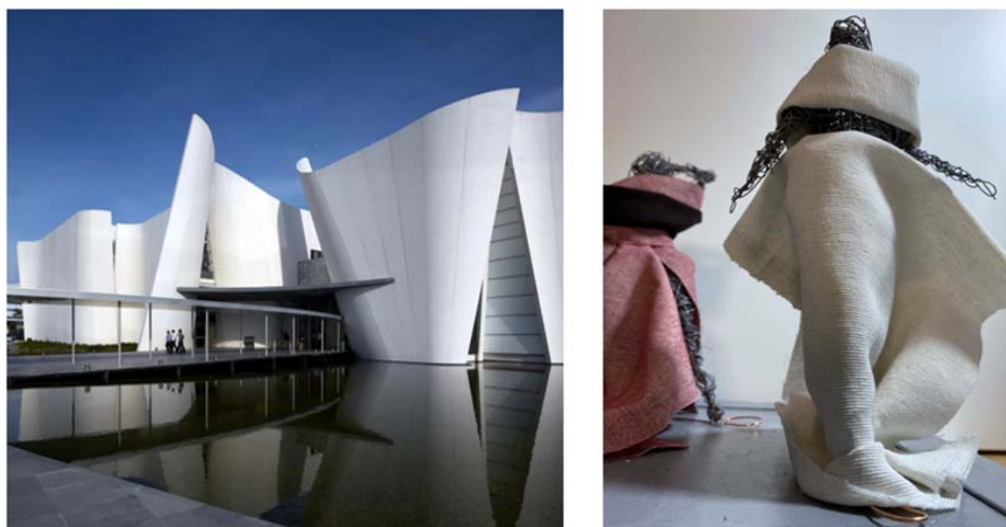


Figure 11 – Comparison of the image "Confidence" with the style of Toyo Ito's Museum of Architecture

The author of the images confidently declares that her fourth image is her desire. This is one of the examples of the quintessence, that is, the worldview of the formed world of a

creative person who has learned the value of life and the power of creativity. All emotions can be experienced and controlled – master yourself (Figure 12).



Figure 12 – The expression of self-control in the example of the image "Confidence"

The completed task, presentation, and collective discussion reflect several interactive learning methods, such as communicative competence, which is extremely important for an architect-designer.

According to Pometun and Pyrozhenko, the technology of interactive learning is revealed as a technology of interaction, cooperation in education, and active partner communication in forms of interactive learning (group, collective, situational modeling, discussions) for the formation of communicative and professional competencies (acquaintance, reflection, brain assault, presentation, etc.) [20].

Also, the student learns the method of project activity in the practical classes of the interdisciplinary discipline "Complex architectural design," which combines both scientific research, the search for the image of the future building, and the search for the integrity of the perception of the architectural environment, which the student-designer organizes in his project based on the actual existing situation and many other points that make up the architectural activity itself.

This discipline is joined by "Presentation of architectural projects", "Fundamentals of scientific research," and "Design of subject-spatial environment". It is impossible to describe the whole process in a short article, but several reference points in interdisciplinary training can be displayed. The stage of complex architectural design begins with assessing the design site and analyzing the situation.

At this stage, the specifics of the student's thinking are considered – in those age-specific features that require identifying specific forms of cognition. Most students have a more developed direct sensory perception. Speculative conclusions are perceived to a lesser extent.

Therefore, emphasis is placed on identifying a scientific problem from their natural impressions of the real environment being studied. These impressions are most fully formed during the period of practice.

The problem identified as a result of the analysis of the situation should become the main problem of scientific research works as a basis for further design in this place. Some drawings and analytical and cartographic materials can serve as an example. Analysis of the design site based on interdisciplinary research makes it possible to create a design concept that reflects the

symbolic and functional features of the surrounding environment. (Figures 13, 14).

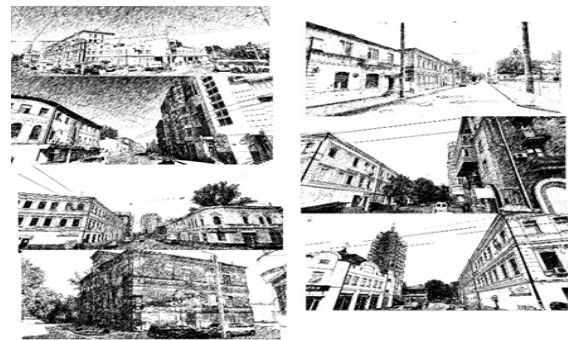


Figure 13 – Full-scale drawings of the surrounding environment of the design site in the city of Kharkiv



Figure 14 – The concept of a design solution. Storyline: from dark to light, from confinement to disclosure

The nature of the existing environment influences the "consumer." If the architect-designer wants to provide natural impressions in the project, he must walk the path the background has prepared for him [2, 11a]. Thus, we approach the most mysterious moment in architectural creativity, the need to "form" the object in an environment characteristic of antiquity and the Middle Ages, where the master put himself in the position of the future "consumer." The architect-designer must preserve the change of impressions that inspired him in the drawings to reanimate this process in more challenging conditions [8, 15].

Not in photographs – mechanical fixations, but specifically in drawings – "romantic embodiment of the figurative inadequacy of real projects," which Frank Wright wrote about. Romantic pictures should lead to a combination embedded in each landscape's potential. The transition process to a combination of points of view can be divided into three stages [3]. In the first, the most "romantic," the task of systematizing impressions is not set. An architect-designer spontaneously gets to know the environment, capturing in pictures impressions arising from the most exciting places. In the second stage, keeping in mind these places preserved in the pictures, a specialist remembers the path of movement to them, which he passed and which the

"consumer" will pass to see them. And then, a functional reflection is as follows: the architect-designer understands that to attract "consumer" to the perception of this beautiful environment, it is necessary to place functionally significant objects in the places of visual revelations. And the road to them should become one of the branches of the spatial framework of the designed environment. And the architect-designer, having defined this path, records the change in spatial impressions. Milestones appear in the pictures – places of the most vivid changes in spatial and light actions. A rhythmic idea emerges to which this space-time fragment must be subordinated (Figures 15, 16).

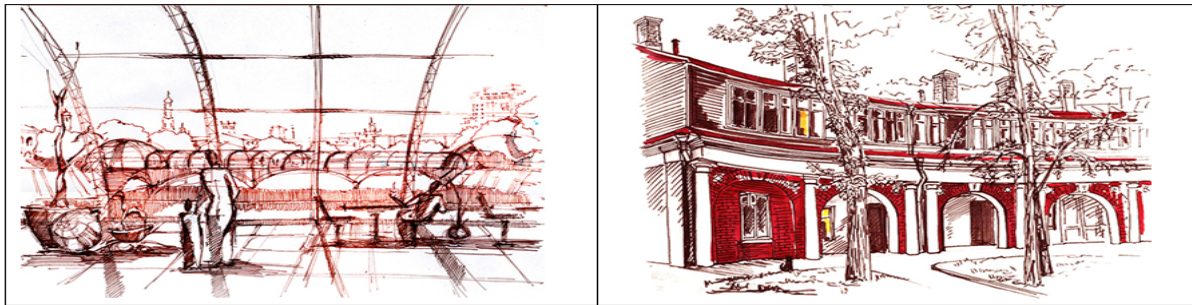


Figure 15 – Graphic representation of a space-time fragment

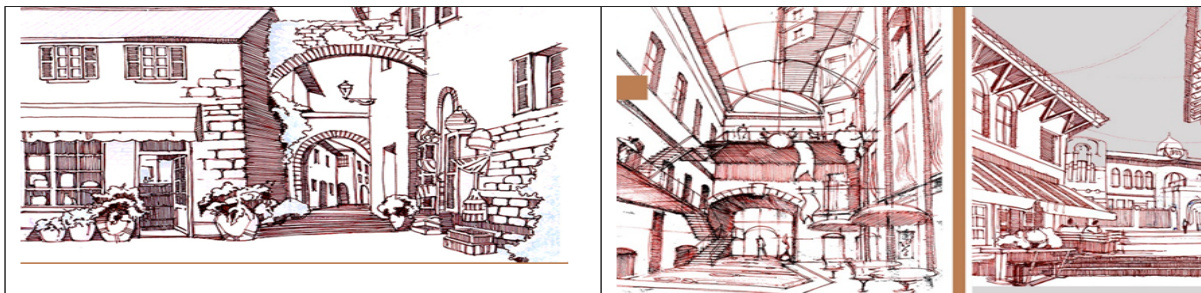


Figure 16 – Full-scale illustrations of the surrounding environment of the design area with abstract proposals in the city of Kharkiv

A problem arises: combining all the fragments into a whole architectural and spatial environment. This is the task of the third stage. For the architect-designer, when fixing the route fragments, a particular form in the landscape "revealed" on which the culminating revelations converged. It is, as a rule, a natural form dominating the landscape. It can be noted that such

a natural center in the Kharkiv landscape is the Kharkiv hill – a plateau with historical landmarks that can be seen both from the streets and the city's courtyards. The Kharkiv Plateau is located between two valleys of the Lopani River and the Kharkiv River, with dams forming the city's recreational frame (Figure 17).

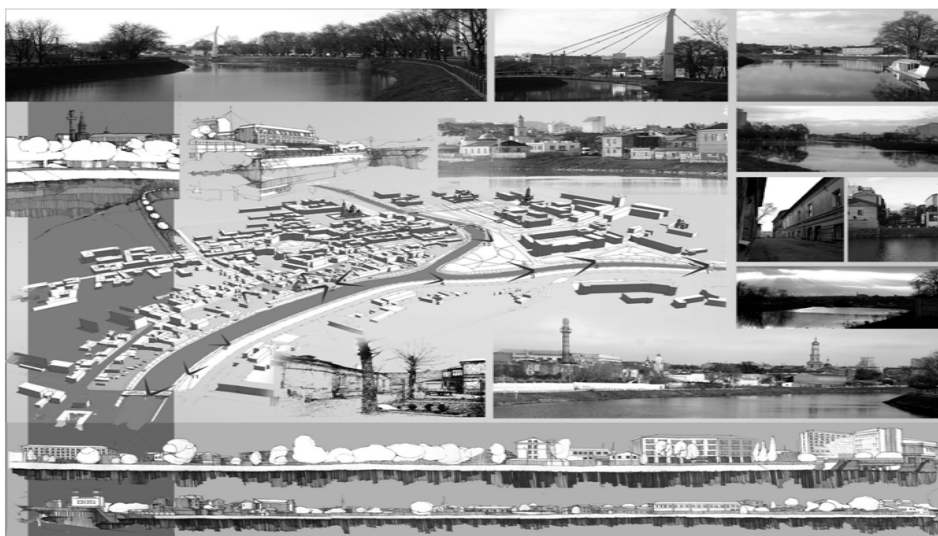


Figure 17– The specifics of Kharkiv: vast panoramas along the rivers and small courtyards with a dense fabric of buildings in its historical part (project proposal)

On one side of the river are the antipodes of the plateau (lowlands – horizontal, plateau – vertical reinforced by architectural verticals), the character of this part of the city. On the other hand, the antipodes are the architectural spaces of the city (tucked in small semi-dark courtyards and spacious bright embankments that reveal vast panoramas). Antipodes enhance the effect of perception of the surrounding environment if they

contrast with the local space. They form spatial gradations – breakthroughs, narrow openings on the plateau with the Assumption and Intercession Cathedrals. And this is also a feature of the place, where vast panoramas are neighbors with the dense fabric of the building of its historical part (Figures 18, 19).

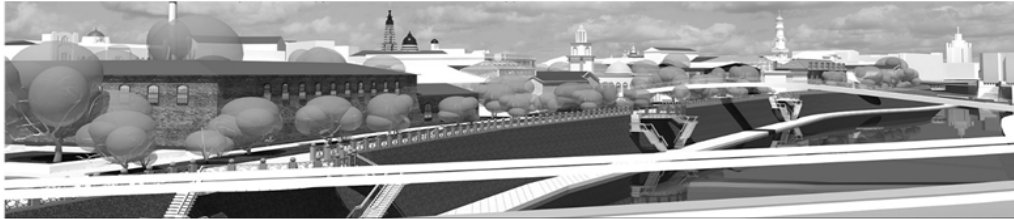


Figure 18 – Panorama of the central part (project proposal) A



Figure 19 – Panorama of the central part (project proposal) B

And then, it is necessary to generalize the impressions of the dominant forms of the landscape and architectural objects in perspective from a "bird's eye view," not built on a topographical

basis, but a symbolic generalization of "earthly" pictures perceived and sketched at different times (Figure 20).

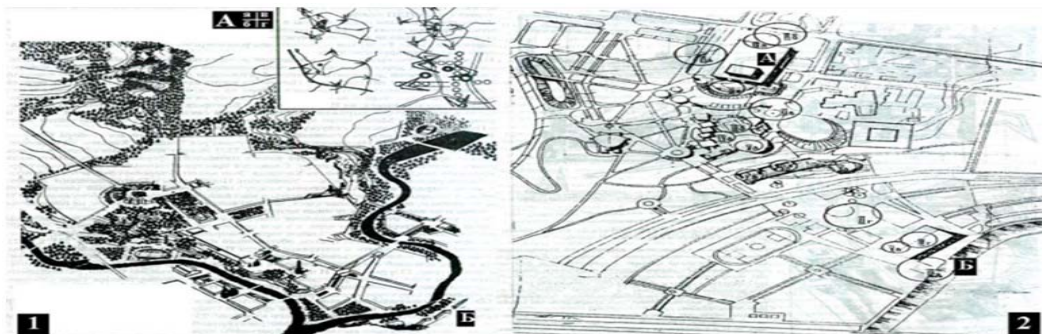


Figure 20 – Generalization of impressions from the dominant forms of the landscape and architectural objects in perspective from a "bird's eye view"

In the mind of an architect-designer, a particular associative whole arises due to the joining of impressions from different times on forms common to them (the concept of "mediator" by Lévi-Strauss and "assembly dominant" by Antonov) [1]. It can be considered that this closing of the associative chain is the basis of the stage of "envisioning" [20]. In the aspect of understanding the "myth of place," "genius of the place," and "spirit of place" in the terminology of Antsiferov, Le Corbusier, and Lynch. Penetration of this "spirit of the place" can see in Figures 21, 22.



Figure 21 – A bird's eye view. A conceptual solution

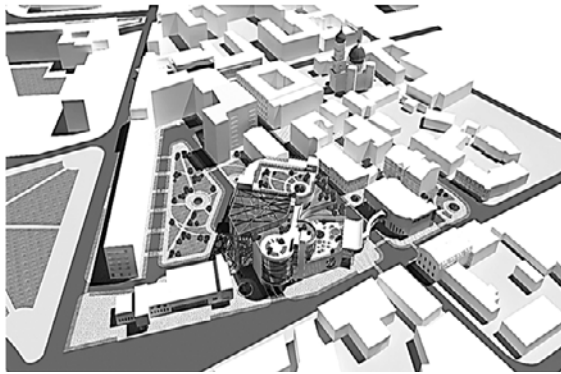


Figure 22 – Project solution. A bird's eye view

The project decision becomes an approval of the conclusions of the research work. The teacher acts as a co-author.

This is how the methods of using role-playing games, joint problem-solving, polemics, critical thinking, etc., are implemented (Figures 23, 24, 25).

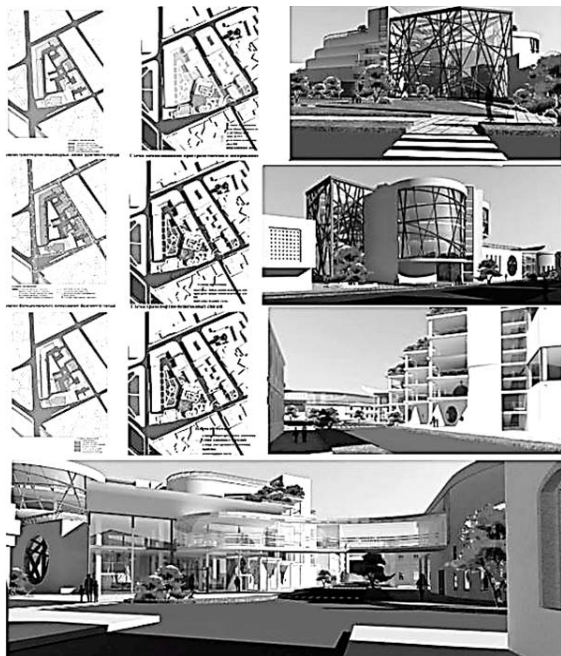


Figure 23 – Analytical schemes of research work and project solutions as an approbation of the conclusions of research work

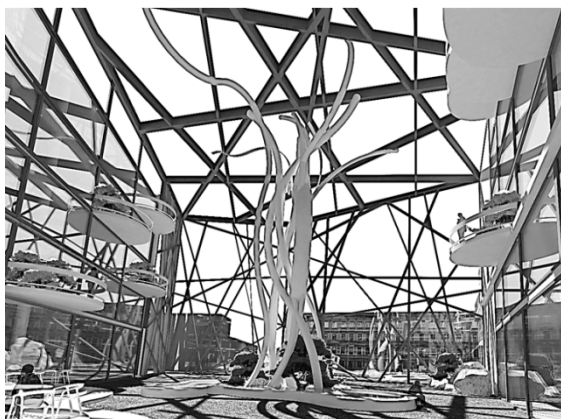


Figure 24 – The internal space of the complex visually absorbs the historic environment



Figure 25 – The collage method provides an opportunity for discussion

Tasks from the subject "Methods and techniques of architectural design" are related to architectural design, where a school or hotel was developed (Figure 26).



Figure 26 – Project of the coastline design (before/after)

Blitz tasks activate working memory, imagination, and creativity. Based on the position of the Charter of the International Union of Architect-Designers of UNESCO, which defines architecture as an interdisciplinary field of knowledge that includes several main components: humanities, social and physical sciences, technology, and fine arts [28, p. 11], it should be noted that the architecture can systematically combine differently directed vectors.

5 Conclusion

The organization of multilateral communication in the educational process by methods of discussion, situational modeling, training, etc., creates an environment for interactive learning. Since design plays the most critical role in architectural education, we can witness the formation of a new educational paradigm based on systematic knowledge and professional activity. The integration of academic disciplines occurs based on the complex architectural design with the selection of specific specializations as an "education-science-production" system.

A narrow-disciplinary approach to architecture removes it from the integral "nature-human-architecture-spatial environment" system and divides it into different scientific disciplines. It needs to give an idea of architectural activity as a whole. At the systemic level, the approach should combine environmental aspects, architecture, engineering, and aesthetics in modern design practice, together with learning methods, both in the regeneration of the urbanized and in the creation of a new environment. The environment for a modern person should be integral, highly comfortable, material-energy, and eco-aesthetic – this is the first thing. Secondly, the inevitable formation of "second nature" should be a part of an ecosystem that can reproduce itself.

On this path, pedagogical models of the organization of architectural education are chosen as interactive, as a system of interactions in the system: "architect-designer-moderator — student-architect-designer — students of the group." Interactive learning technologies are based on a personal-activity approach. They include non-situational (dialogue) and situational (gaming and non-gaming) learning methods. During interactive learning, there is a mutual process (collective, group, and cooperative learning) where students and teachers are equal in education subjects. During interactive training, the teacher is an organizer of the learning process and a consultant. The main thing in the learning process is the interaction between students and the teacher – cooperation between participants. This whole process reflects the "education-science-production" system.

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Primary Paper Section: A

Secondary Paper Section: AL, AM, JM, JN