MODEL FOR TRAINING ENGINEERING DESIGN STUDENTS BY USING METHODS FROM HUMANITIES AND SOCIAL SCIENCES

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ABSTRACT

This article presents a successful model of training practice as part of the student's education in "Engineering Design" (Interior and Furniture Design) Program at the University of Forestry. Stimulation and emphasizing the strengths of the learners by provoking a new teaching style for the traditional training of designers and engineers is the main accent of this model. The model itself is not just conceptual, but also applied in the training of students in design programs and could be also successfully implemented in a wide range of cross-disciplinary platforms in the training of designers and engineers (and not only). At the same time, this innovative approach highlights new forms of support for students' learning progress, expanding the operationalization of their involvement in direct work with clients with diverse status and needs.

Key words: design, project week, design project, rehabilitation through design, educational management, students' potential, universal design.

INTRODUCTION

The "Engineering Design" Program is a time-approved, recognizable and clearly structured category for years, not only at the University of Forestry. Its relevance in the XXI century is indisputable, especially through the constant investment of new technologies in student education and teacher training. In this spirit of innovation, it is clear that offering new situations is mandatory for each new class so as to better engage the potential of the learner, maximize the capacity of the university and best stimulate inter-institutional and inter-organizational cooperation in such a situation.

Engineering training involves clear parameters, precise guidelines, explicit definitions that are visible and measurable in units such as meters, consistency, degrees and so on. In contrast, the method used by social sciences is based on spectral characteristics of the human character, the issues of verbal and nonverbal communication, the variations of emotions in a given (often immeasurable) moment, individual perception and group dynamics together and separately. Although the training in design skills strives to take into account in its production the "human" side of the objects and the designed environments, in the "Engineering Design" program mostly an engineering approach is applied and rarely a humanities approach.

To a large extent, the combination of the engineering and humanities approaches aims to stimulate the parties involved in the creation of products valid for the so-called "Universal design", where the concept of prior full meaningfulness leads before solutions that may be adaptable in the future.

MODEL CONCEPT BASE

The model for students' "Engineering Design" program training through social sciences methods aims to provoke the learner to create and use new, hitherto unknown points of view to the already acquired knowledge. On this basis, the learner is encouraged to use

previously uninvolved resources in the standard training and to reveal for itself, for its teachers and for its colleagues strengths of the personality, which did not have a platform for expression in a conventional engineering environment. At the same time, by changing the point of view, the learner has the opportunity to develop and think of engineering tasks in different dimensions. This creates conditions to fully develop and upgrade the targeted engineering result with additional functionalities and benefits for the end user. The humanities approach enriches the ideas of the learner with social experience, which is often not personally acquired at the standard age for the student (20-30 years), but is necessary for the professional judgement and quality of applied knowledge. It also generates skills in the student, through which in challenging situations for the profession will be possible to create hypotheses in a non-engineering way, which will be reflected in full-fledged engineering solutions.

The Model is seriously challenging each participant, as it puts in a new role, new position and new point of contact teacher, student and environment, aiming at the same time to achieve a "traditional" engineering result and a specific product. Therefore, the Model is effectively applied at the essence of engineering design in upper classes (after second year of study) – when students have a clear vision of the mastered profession, good orientation in the subject and even their own position in the study program. (Angelova D., R. Raycheva, R. Chipev., 2019)

Everything conceptually presented so far corresponds to the task of each university to fully develop and deploy the personality of its students to the vast possibilities of academicism and at the same time to the clear foundations of practicality, so the University of Forestry embraces the opportunity provided by the Model for the first time in this way in the XII design project (Project week) of the University of Forestry.

The Model requires external experts to support students only through a humanities approach, avoiding the categorical use of characteristics such as exact sizes, volumes, shapes. The presentation of the technical characteristics for the needs of the students should happen only through the description of processes, emotions, situations, possibilities, human experiences. This requires the support of the teaching staff to be with a minimized engineering definition, involving all teachers in a situation to express themselves with atypical means for their field.

DESIGN PROJECT (PROJECT WEEK) OF THE UNIVERSITY OF FORESTRY

The „Design project", formerly known as "Project Week", is an interactive student training opportunity that includes lecturers from the University of Forestry, students and external experts, especially involved in the thematic scope of the week. The week is held within 5 days, in which students work in randomly selected teams and challenging tasks, which must be brought to the final product within the week and at the same time be presented in a high quality attractive way and evaluated by a jury. The event is on a competitive basis, and the winners receive special prizes for first, second and third place.

Students have the opportunity to receive support from professors and external experts, without direct interference in their work. The jury is composed of lecturers and external experts and evaluates originality and innovation, functionality, aesthetics, rationality and way of presenting the idea in a five-point evaluation.

The design project takes place on the spot at the University of Forestry, and students have access to the available specialized equipment they need to develop their ideas.

In general, the designated five days cover conceptualization of the idea in the newly created team; identification of thematic contact points for support by teachers and experts; monitoring by teachers and experts; discussing the progress and comparing with the results of the work of the other teams; on this basis, revision and improvement of the idea; preparation of Its presentation and explanation before an evaluation commission, incl. through deliberately created additional products such as models, digital visualizations, posters and others; presenting the concept in a competitive manner among the teams.

APPLIED MODEL

In the XII "Design project" ("Project week") – held on November 2020, due to the specific conditions imposed by COVID 19, the activity of all involved persons is realized on-line. This caused further complications of the task for all participants and created a basis for a new point of view of the application model, supplemented by the possibilities of the accompanying digital environment and the lack of direct face-to-face contact in real time.

The thematic scope of the XII "Design project" was "THE GAME OF THE CHILDREN". There were 5 teams from the fourth year of study (last for the study program). All students are located in different geographical areas in the country and communicate virtually, mainly through MS Teams.

I: The student's assignment of XII "Design project" covered only the following details:

1. The project should fit in dimensions 7x11 meters;
2. The project should be applicable in internal and external conditions;
3. It is an advantage if the project offers the possibility of relocation;
4. A playground with remote-controlled cars should be designed;
5. The terrain should provide space for development and improvement of fine motor skills, concentration and social skills of its direct users;
6. The field must form an innovative professional space for the experts from social sciences, such as psychologists, rehabilitators, therapists, social workers and others;
7. The project must create a space for active social functioning through the experience of pleasure.

The specific assignment is a totally new subject for the students. Within 5 days, each team must create and improve their project so as to offer the best solution for the given thematic scope and present it in the most attractive way in less than 5 minutes, including the evolution of the idea and the revealed and solved problems. (Raycheva, R., Angelova, D., Vodenova P., 2016)

II: The instructions to the external experts are to actively support the students without using specific proposals in their advices. In XII "Design project" Ophelia Kaneva from "Agency OZON" and Ivan Ivanov from "SONIK START" took part as external experts. Each answer to a student's question should be based on characteristics, emotions, impressions, and not clear dimensions, materials or other types of engineering answers.

III: The specific instructions to the teachers (in the XII "Design project" participates Prof. Regina Raycheva, Assoc. Prof. Desislava Angelova, Assoc. Prof. Pavlina Vodenova and Chief Assistant Prof. Rangel Chipev) were:

1. to support students both methodologically and administratively (mostly with the maintenance and provision of everything necessary in an on-line environment);
2. to assist in reduce anxiety produced by tight deadlines and the unavailable physical contact (which is traditionally reported as an advantage for the intensity of the design project);
3. to support communication by stimulating quality communication through exchange of ideas and constructive comments;
4. to encourage the structuring of the ideas in the teams, incl. by stimulating sketching, drawing, text descriptions, collages and other creative techniques;
5. to monitor and report the progress of the work in each team.

IV: The students have been announced that there is an opportunity for the practical implementation of their projects in different cities in the country – which enlarges the motivation, but also increases the responsibility in team working.

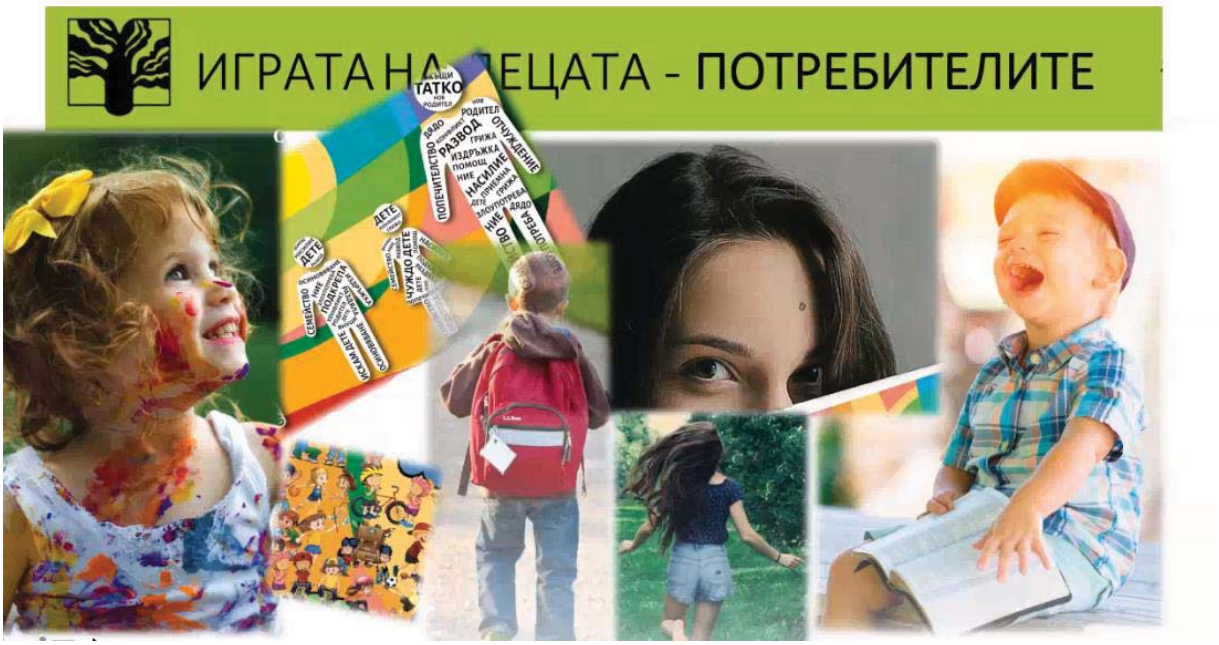
MODEL IMPLEMENTATION IN DISCUSSIONS AND EXAMPLES

Creating a live project with high probability of implementing increases the requirement for precision of work, raises a series of questions and narrows the freedom of abstraction in the conceptual phase. Clarification of the applied humanities approach in the engineering situation can best be represented by examples from discussions with students:

1. What is the target group?

a. The answer in the traditional approach of the design-project should sound like this: users of age "from-to", with intended growth "from-to", with indicative number "from-to".

b. The answer during the XII design-project was formed as follows: playing is a functionality of every human being, regardless gender, race, ethnic or religious affiliation, age, nationality, occupation or other characteristics. Games can be held individually and/or in groups, at any time, in different states of mind and body. Therefore, the target group of the proposed project should take into account these characteristics.



2. What is the size of the remote-controlled cars?

a. The answer in the traditional approach of the design-project should sound like this: cars with scales of 1:10, 1:16 or 1:24.

b. The answer during the XII design-project is formed as follows: those which could most easily be found in the stores, at affordable prices, adequate for every gender and age.

3. Should there be a fence?

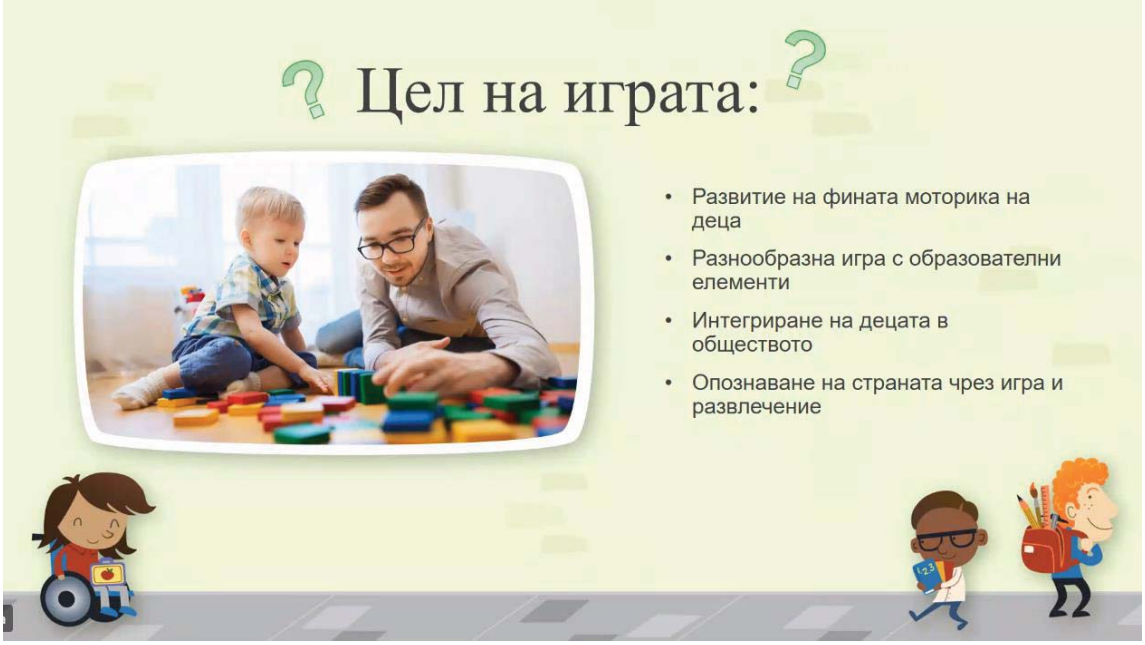
a. Taking into account the nature of the users, as well as the fact that people with disabilities are also likely to use the facility, a fence can be both an obstacle and a necessity. This problem should be specified and argued by the authors.

b. Playing process is usually associated with connectedness, togetherness, unification. A game has many different faces – it is an economic tool, a psychological vent, an educational motivator, an organizational catalyst, an individual stimulator, an intellectual challenge or a social achievement. In this spirit, the answer to the question should be considered.

4. Should there be a sitting area?

a. The place of operation of the facility, as well as the duration of its use by users must be taken into account in the final decision on this issue. In places for recreation, it is generally good to promote comfortable furniture for rest.

b. Playing is a movement, but also complying to rules. If the concept included in the project considers rules for waiting – it is logical to include seats. If the concept embedded in the project includes elements of mobility related to sitting – seating should also be provided.



5. Should there be signs and written instructions?

a. The signs and instructions can be used not only for education and training, but could also be part of a game or competition, i.e. can be a nice addition. However, the height of their placement, as well as the materials from which they are made, must be carefully considered.

b. The process of Playing often raises questions and possible answers are sought, this moves the participant in the search for other questions and answers – to explore the paths in the labyrinths of knowledge and ignorance, to get to know yourself and others

better, to search and find. But everyone participates in the game with own available and scarce resources – some cannot read, others cannot understand, and some have difficulty seeing. At the same time, the playing field should offer equal conditions for participation of all, according to the assignment. In this case, the inclusion of signs and instructions should be considered in the context of Universal design so as to ensure equal and full treatment of each party involved.

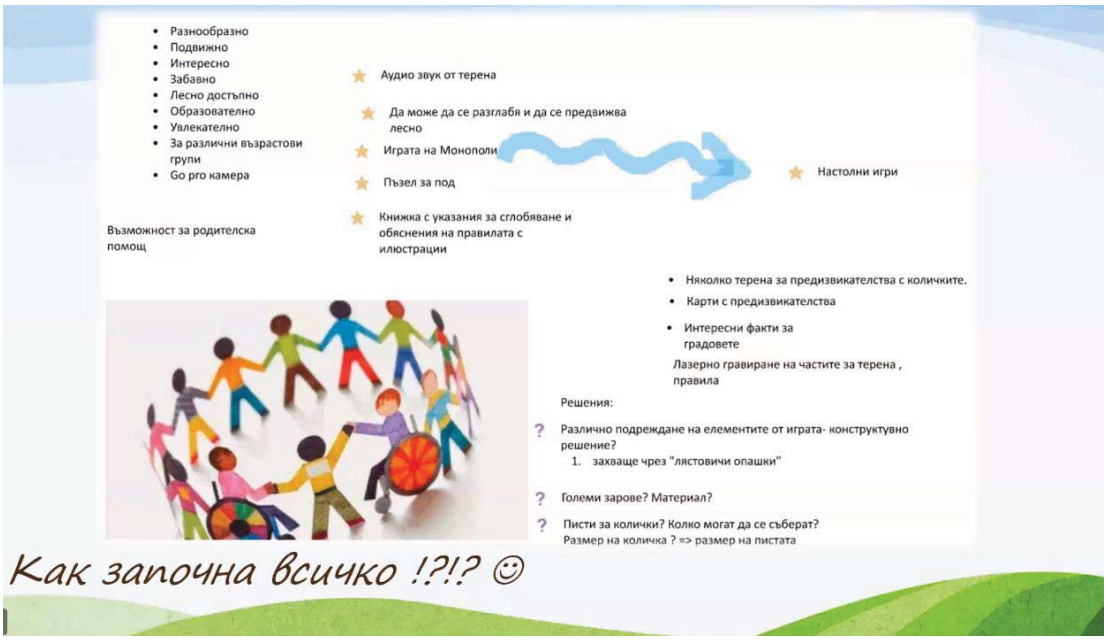
6. What do professionals need to successfully explore the playground in their direct work?

a. Each profession is conducted in a standardized work environment, for which clear guidelines are published for work premises, specific equipment and the necessary subject facilities. Usually these values are available on-line, not only in Bulgarian.

b. Nowadays, games are powerful tools in the training and practice of professionals – especially those in the humanitarian field. Because, in fact, playing evokes the feeling of superiority to (re)discover the human reality so that parallel realities are experienced – long before we get used to the virtuality of the XXI century. In this regard, the professional needs an active stimulating environment in which the user feels comfortable and in place to be able to function most effectively within the playground.

In cases where the work is done with people with disabilities, the professional will need a playground to support physical functioning so that rehabilitation does not look like a corrective activity, but causes a feeling of pleasure and progress. In situations where work is done with people who face deficit of concentration, a professional will need the playground to support the gradual attraction and increase of interest in the activity, allowing growing retention of presence in the game process – so the stimulation of concentration will be will be of maximum effectiveness. In cases where a professional works on purely cognitive tasks, the playground will have to offer opportunities to clearly distinguish colors, shapes, sizes, directions in the mind of the user so as to support the cognitive work carried out by the professional. In cases where work is being done on upgrading social skills and capacity, the playground will have to provide sufficient (but also) diverse spaces for delicate contact between two or more entities, while ensuring smoothness in this process and the possibility of increasing time concentration of contact points.

It is possible for more than one professional with more than one user to work on the playground at the same time, with a different scope of professional intervention.



7. Who creates the rules for playing on the playground?

a. The designer who sets the elements of the project.

b. Games are often perceived as an escape from reality, in fact it is also piece of the ordinary life of each of us. When they are part of everyday life they often raise the question "Why is it that pleasure is not so intensely felt in ordinary people's life? And if it is an escape from reality, we may ask how it manages to drive people and events of all ages and spaces in real time? In this spirit, whether the player is the master of the game is a relevant milestone to think about; as well as as whether the physical environment is the only formative factor for the game.

However, we should also consider the fact that the design of the playground for remote-controlled cars is actually a task to create a new working environment for active professional social and physical rehabilitation. In this line of thought, given the functionalities in the nature of the social workers – the playground should be able to bring both opportunities to emphasize the actual abilities of the player, and possibilities to escape from them; both chance for establishing good and strengths, and power for discovering, learning and acquiring new skills. In this line of thought, the empowerment of the participant is no less important factor in the rehabilitation process than the professional intervention of the social worker – therefore the playground should be designed so that its rules are both clear and understandable, but also with the possibility of discovering new dimensions of environment and people, as well as opportunities for new roles of objects and people.

SOME CONCLUSIONS AND REFLECTIONS ON THE STUDENT'S TRAINING MODEL

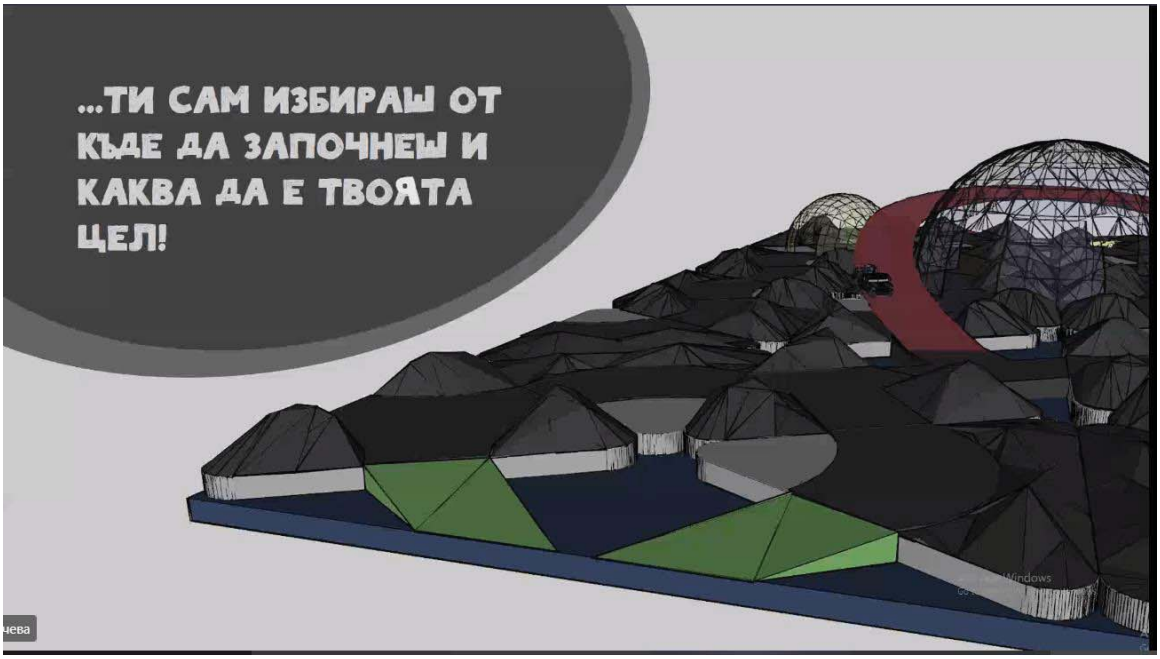
1. The presented Model for student training is a product of combining experience gained over the years by both engineers and humanities specialists. As such, it can be implemented in a learning environment in which there are professionally and life-trained teachers, confidently leading students to new dimensions of design study programs.
2. The spirit of cooperation, quality communication, the search for strengths and the positive attitude

between all participants involved in the situation – teachers, students and external experts are of great importance for the effective implementation of the Model.

3. In the XIIth edition of the Design Project, the direct provocation comes from social science. Differentiation, integration and coherence of already known process and available study content of theoretical courses taught at the University is subjected to a challenge, in order to create a new platform for methodical and practical activity with students. From methodological point of view, this constitutes a key moment; because opportunities arise for evaluation of one's own strengths, identity and direction. Thus, a basis for planning of activities, based on the strength of the customer, is being created.
4. The presented Model would not be sustainably applied if it does not develop a growing sensitivity to the constant feedback between the involved participants – both through the recognizable monitoring (and not only) mechanisms of the traditional design-project and through the forms of joint reflection on "unknown" humanitarian matter.
5. Strengthening mutual exchange; support; professional but also personal communication between students, teachers and experts reveals in essence the progress of learners in an ambitious professional environment, allowing an advanced and anticipatory order of thought for all parties involved – both individually and in team identification.
6. The structure of the Model is flexible and challenging, relying on the strengths of the participants and not on the deficit of the accumulated knowledge and skills. By encouraging the strengths, a mechanism is created to improve the motivation to learn and achieve a tangible product of the efforts; improvement of the acquired theoretical knowledge in direct connection with the reality of the potential users; growing sense of satisfaction and professional potential; a sense of empowerment and determination in the scope of engineering design (and beyond).
7. The Model creates conditions for deep, detailed and quality orientation in the opportunities of the profession and the acquired knowledge.
8. The Model creates a space for finding oneself in a new professional role, form and opportunity; entering the dynamics of real design processes and the supporting functionalities required by modern engineering design
9. The Model creates a new groundwork for understanding the possibilities and limits (rather, limitless possibilities) of the support that design creates for the lives of people, professionals and the relationships between them in a professional and living environment.
10. The essential element of active support, positive attitude and emphasizing the strengths of the proposed Model does not exclude the formation of criticisms, shortcomings or weaknesses. With the peculiarity that they are necessarily based on the emphasis on achievements and not on their scarcity; by limiting the

opportunities for failure, not focusing on the possibility of failure.

11. The integration of the student's own experience is brought to a decent platform so as to experience the professional position from the university environment, forming a behavior of confidence, but also skills for multifaceted assessment of (one's own) opportunities and non-traditional approach.



CONCLUSION

The contemporary topic and the direct contact with an external expert sharpened the student's attention to the importance and interest in the chosen profession. The design-project can be characterized as a memorable moment in the otherwise monotonous educational process, a moment full of positive emotions that leaves vivid memories in student life. Everything described successfully stimulates the creative potential of young people (Raycheva, R., Jivkov, V., Angelona, D., Vodenova, P. ,2016).

The proposed Model for student training is innovative for engineering environments, together with it is really successful in academic practice. It generates a spirit of cooperation, quality communication, identification of strengths and a positive attitude between all participants involved. It develops a growing sensitivity to the constant feedback between participants, reveals the essence of the progress of students in an ambitious professional environment, allows anticipatory intellectual behavior and empowers students with a strong sense of determination (and not only).

The Model provoked the methodological and practical orientation in the students' activities so as to contribute with new opportunities for assessing the strength of their own idea, for the integration of their own experience and ultimately for investing in the personality of the student and others involved – a key moment in modern education requiring resource management through dynamism and exactitude in an environment of traditional scarcity.

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