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ADVANCED DESIGN METHODS APPLIED IN DESIGN EDUCATION AT THE UNIVERSITY OF FORESTRY

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ABSTRACT

This report will present the results achieved by Engineering Design students, Bachelor Degree during semester 6. The developed methodology is implemented in the design discipline 'Residential Interior and Furniture Design'at the University of Forestry in Sofia, Bulgaria, and it is a part of PhD thesis entitled "IMPLEMENTING THE SYSTEMATIC APPROACH IN CHILDREN ENVIRONMENT DESIGN FOR THE CONTEMPORARY DWELLING". The methods used in the design class are observation and analysis of results, demonstrated by students.

To make the understanding of design methodology easier and clearer, specific examples are considered. Initially, a simplified (to a certain extent) provisional design scheme is analyzed and gradually progressed to a more complex design assignment.

Key words: systematic approach, design methods, training experiment.

INTRODUCTION

One of the main approaches to explore a system is its modelling, i.e. the abstract reproduction of its structure, the theoretical provisional differentiation of its elements. It is necessary to reach a universal structure of the image system, which would be valid for all of its further states of development, for all kinds of design solutions, for all levels of space organization, i.e. the structure, which would be invariant in all circumstances. (Hubka, 1988).

METHODOLOGY

Every designed object can be characterized by certain features. The most important feature is the main function of the product (or the system). Other, secondary features, are convenience, safety, aesthetic perfection, and etc. All these features, in their unity, have to guarantee the bipartite unity of function and form, i.e. of utility and beauty.

Primarily, when a product is designed, or program of products, it is necessary to make a list of desired features, specified for this particular product. This list constitutes the design assignment. During the process of designing, the optimal solutions for realization are sought in a close correlation with the relevant form-building factors.

These features represent the variables in the system. This model of the design process is very simple; therefore, for a deeper acquaintance with the stages, it needs to be detailed. (Runge, 2003).

The goal of creating a new product is to examine the specific situation where it should be used by different associative or deductive methods to analyze the environment in which it is used, as well as the customers it will serve. Thus it is very likely that an unresolved problem or situation may be reached, which do not have adequate solutions. A fundamentally new product can be created in that way, which initially could represent incompatible combination of functions. For this purpose, it is important to follow the methodology below:

1.1. Problem analyzing

The presence of specific or unresolved problems, as well as problems with insufficient solutions is essential in creating a product that could have future implementation.

1.2. Study of the influence of the environment on form-building of system elements

During the environment development it is necessary to account for all the elements that constitute this complex system. Through consideration of the problems accompanying the development of the topic can be analyzed simultaneously in two directions – complete design environment and design of individual elements (furniture, architectural elements, etc.). (Jones, 1986).

Considering each product as an independent system as well as a part of a complex system, we analyze its functions at all levels: from the functions of the total system (the main function of the product) to the functions of subsystems and its elements (sub-functions).

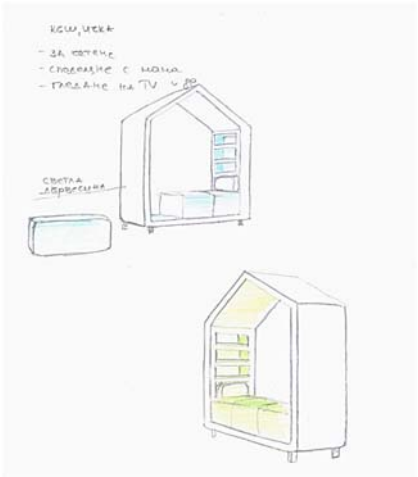
1.3. Main functions and sub-functions

In specialized publications, the term "function" is used with different meanings. Nevertheless, we intend to bring diverse views to two main groups. In the first group "function" means the intended use, the manner of its use in the most direct sense. This understanding is limited primarily to physiological, ergonomic, biological processes and ensuring their optimal functioning. The expanded view of the function of products includes psychological aspects, i.e. psychological comfort of users. (Angelova, 2011)

Each product can provide a function, which is the basis and consists of separate sub-functions, or additional functions. It is vital that these sub-functions are not selected at random or as a result of creative inspiration, but are included as an option in the product following a comprehensive analysis of both the activities and their dynamics depending on the area of application of the product or the age of the user.

At this stage only the possibilities for combining various functions are explored, without specifying the design of the final form.

Table 1.3.1: Combining functions, analysis



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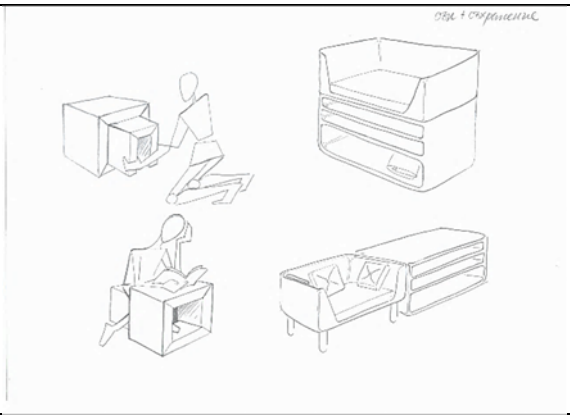

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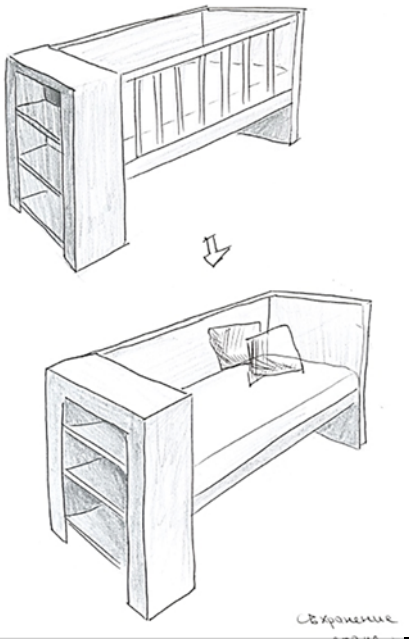

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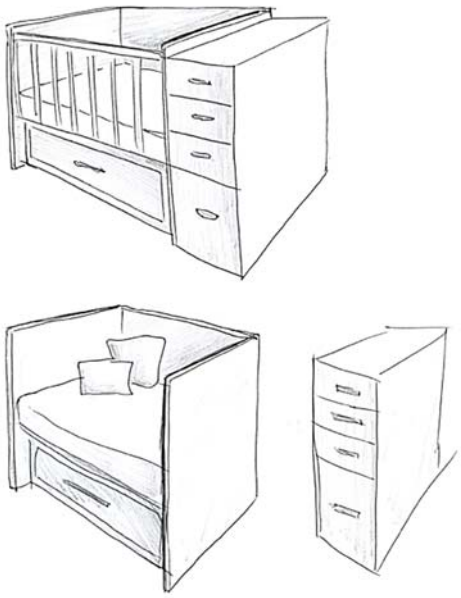

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**Student's design research sketches*

1.4. The way of designing the main functional elements.

After selecting the most appropriate combination, it should be proceeded with designing ways of realization of a particular solution, i.e. method of carrying out the desired functions and sub-functions.

The design of sub-function is realized by so-called functional elements. Each functional element can be built of a single piece, or could combine a few parts in one. The shape of the parts and the links between them are not explored at this stage. The methodically correct thing to do is to initially determine the working surface, i.e. surfaces of the elements that provide various sub-functions. Having these actions completed, the next thing is to explore different variants of structures of the product. The next step of the design process is to determine the resulting structure.

1.5. Optimizing structure

The composition and the relative location of individual items are established. The structure is represented by contingent schematic diagrams, or provisionally designated

items. At this level of design process, no decisions are to be taken regarding the design of individual components, only variants of principal layout are offered.

Table 1.5.1: Optimizing structure – student's design research sketches

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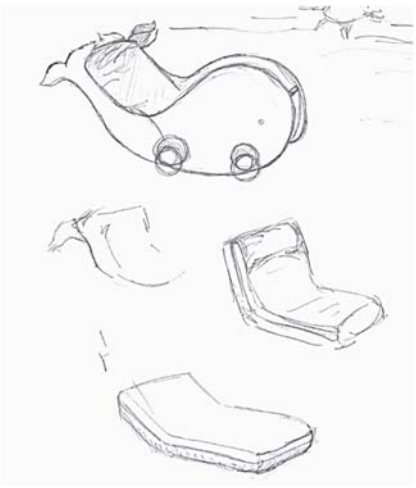

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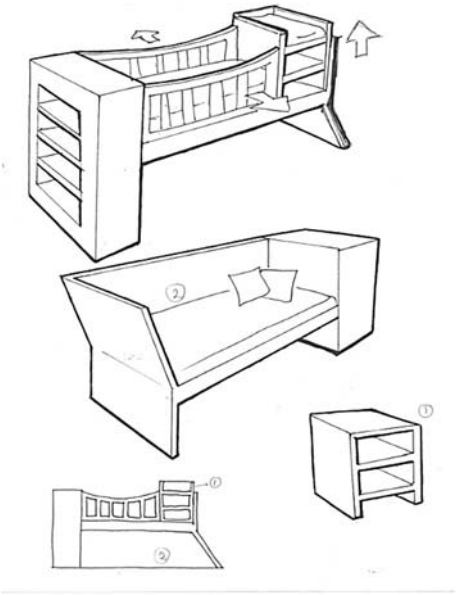

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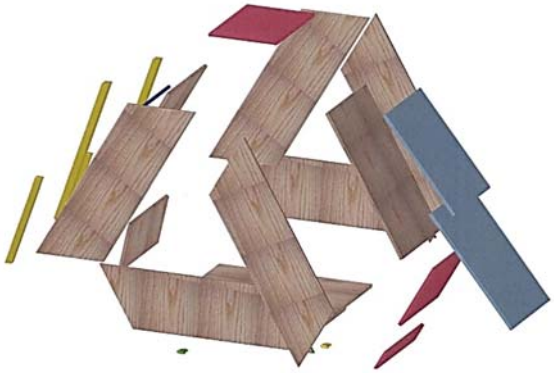

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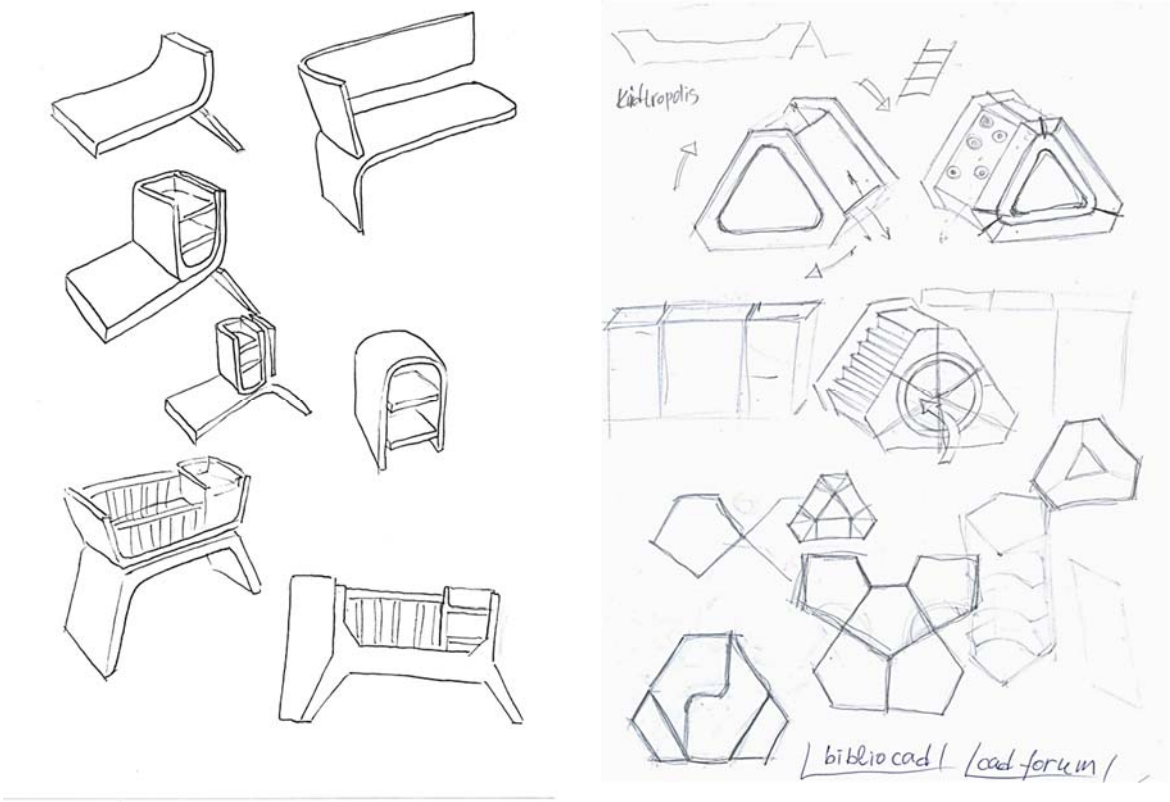
1.6. Determining the general form and shape of the individual elements

When an option and a certain quantitative structure have been selected, it should be proceeded by determining the overall shape, simultaneously designing the shape of individual elements. This is done by drafts or sketches. In the next stage the formal parameters of items are defined and should be subjected to the overall composition of the product. So we get a few different generalized solutions for the form of the product. The resulting solutions are elaborated and detailed taking into account the form-building, technological, aesthetic, etc. factors.

Table 1.6.1: Determining overall shape and form of individual elements



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**Student's design research sketches*

RESULTS

Application in the educational process

This paper will present the results achieved by Engineering Design students, Bachelor Degree during semester 6. The developed methodology is implemented in the design discipline "Residential Interior Design and Furniture".

Task 1 – Design of bi- or poly-functional product for children

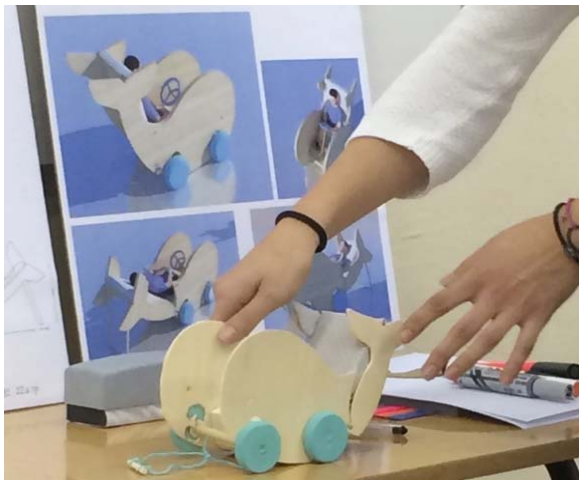
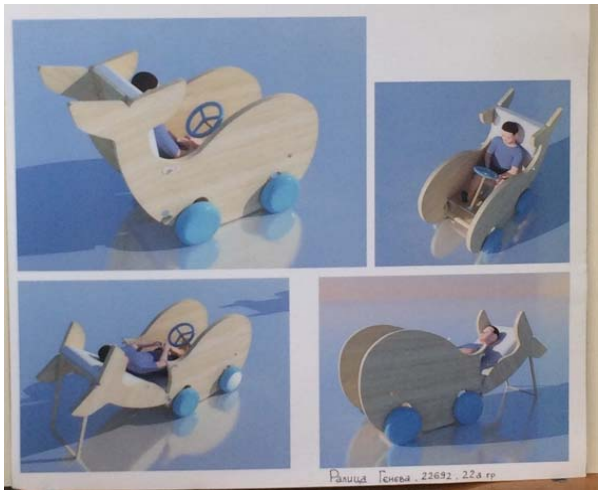
The goal of the assignment is to study possibilities for combining two or more functions in one item through use of the aforementioned methodology based on the systematic approach, and to create a conceptual design for the item, presented by images in perspective, views, sections and explored items and an analytical part presented by sketches. In addition, ergonomic, functional and structural analysis is to be made, as well as a model and an analysis of existing models. The task is approbated during the 2015-2016 academic year.

Mode of work – individual

The duration of the task is 10 weeks of the semester, i.e. 20 lessons. The task is part of the Bachelor Degree Engineering Design student education under the discipline "Residential Interior Design and Furniture".

Results: The presented projects are successful in their majority, working on them is pleasurable and following the methodology leads to achieving the desirable results without problems.

Table 2: Prepared items – presentation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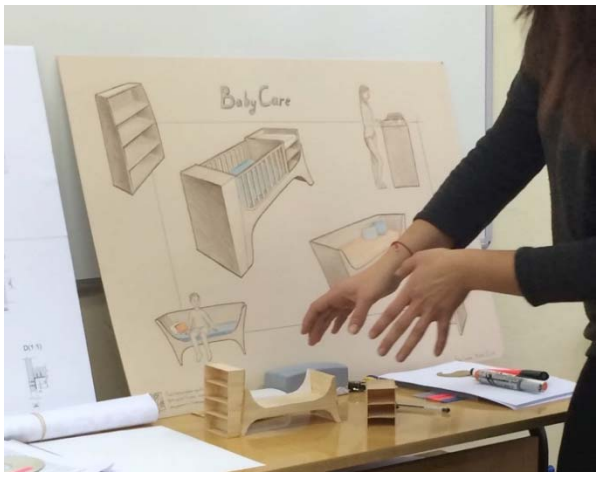	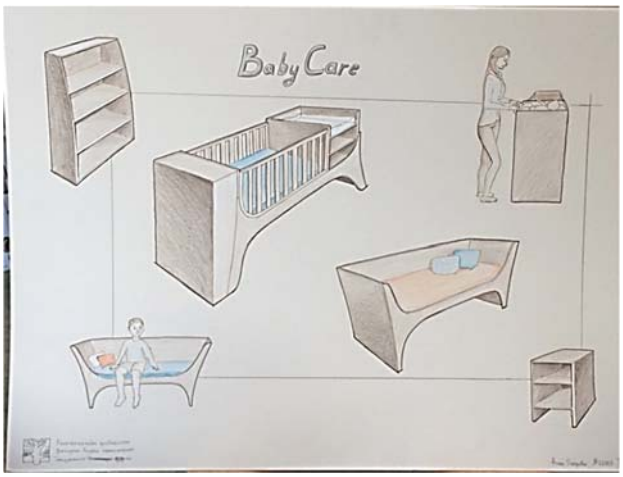
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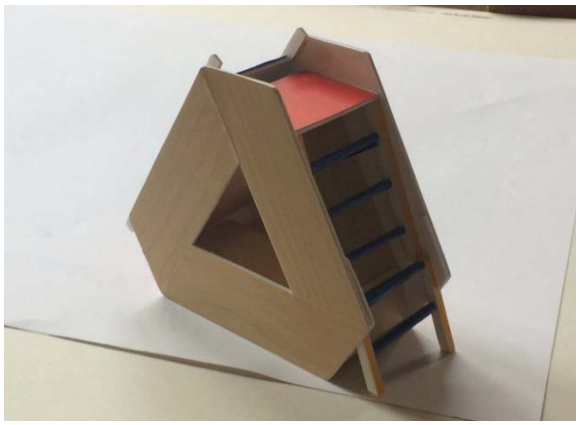	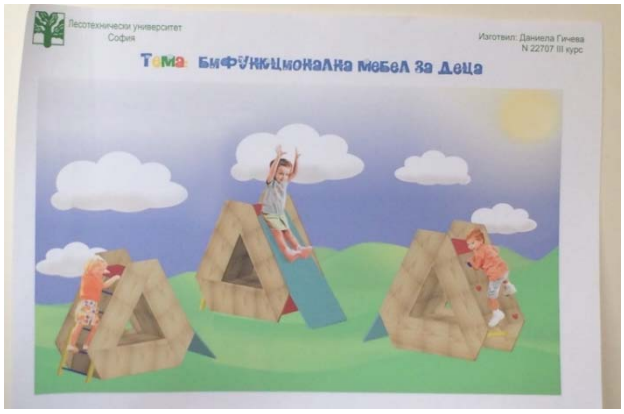
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**Student's design research sketches*

Inferences: As a result of the brainstorming as well as the analytical part related to studying the activities characteristic of each sub-period of childhood, many interesting and unique concepts are developed for multifunctional products, which not only combine different activities, but are also designed to last long and serve different needs in different childhood periods.

CONCLUSION

By following the methodology and observing the different sub-stages, the developed items are innovative and serve not two, but three or more functions. The achieved positive results in almost all student projects stem from proper structuring of the project work, despite the lack of specialized knowledge in base disciplines, due to fact that they have not been studied in enough depth during the approbation of the task.

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