DESIGN THINKING AS AN APPROACH FOR SUSTAINABILITY

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Abstract

Papnek (1971) can be considered as the first researcher that raise the issue about environmental and social responsibilities of the designers. He started than a whole new movement called ecodesign or design for the environment (DFE) which nowadays evolved toward sustainable design involving the social and ethical implications of the products.

Design thinking is user-centered approach to problem-solving that emulates the ways in which designers think and work and it dates back to the 80s, but it gains popularity in the recent years as an approach for complex problems solving.

There are not lot of evidence of implementation of this approach into the academia, this is why we wanted to conduct this kind of research. In our opinion the aspect of reflecting as part of the design thinking approach is also very important element in the academia. We conducted this research within the course Research in design, part of the Industrial Design curriculum at the Faculty of Mechanical Engineering in Skopje.

At the same time in our opinion the design thinking approach is the most appropriate for design with social impact, which is the area that we are working. One key element that give us optimism that this is appropriate approach is its aspect of empathy.

In this paper we present two student projects that are dealing with problems in the area of sustainability. The problems were chosen by the students, we wanted for them to be familiar with the issue, have some connection to it or fell very strongly about it. This was important for the research, because the time that we had is not very long to establish connection with some issue and develop strong feelings and empathy, so we wanted to have head start. The only requirement for them was to be a global problem, influencing larger group of people.

Keywords: design thinking, conceptual design, sustainability, design with social impact

1 Introduction

Papnek (1971) can be considered as the first researcher that raise the issue about environmental and social responsibilities of the designers. He claimed that the designers can have influence in the raising awareness or even change the user's behavior. In the following years many researchers and authors tackle this topic. Burall (1991) argued that there was no longer a conflict between a green approach to design and business success. Fiksel (2009) discussed how design for the environment (DFE) integrates life cycle thinking into new product and process development. As the DFE process matured, Brezet and van Hemel (1997) provided a practical guide called Ecodesign. Nowadays the terms ecodesign and DFE have evolve into sustainable design giving in much broader concept by involvement of the social and ethical implications of the products (Ulrich & Eppinger, 2015). There are authors who go beyond and explore the conceion between behavioural design and sustainable design (Lilley and Lofthouse, 2009).

As this broder concept evolves it reguiers different approaches in the design proces. Design thinking is user-centered approach to problem-solving that emulates the ways in which designers think and work (Brown, 2009). It dates back to the 80s, yet in gains its popularity in the recent years as an approach for complex problems solving (Dorst, 2011). Design thinking is iterative, nonlinear approach which is a result of its exploratory nature, resulting with unexpected discoveries and innovative solutions. The risk of such an iterative approach is that it appears to extend the time it takes to get an idea to market, but this is often a shortsighted perception. To the contrary, a team that understands what is happening will not feel bound to take the next logical step along an ultimately unproductive path (Brown, 2009). This approach involves the users into the process, sometimes even in co-designing which strengthens the possibilities for successful products/services.

There are numerous examples of implementation of this approach in the academia (Vega et al., 2017; Lor, 2017; Hollohan & Browne, 2019). Guaman-Quintanilla et al. (2020) are confirming in their research that this approach has positive effect on the teamwork, problem-solving and creativity. The evaluation and reflection as part of the design thinking approach are also crucial in the research and academia. This is the premise that made the authors think that applying design thinking into Industrial design engineering curriculum is the right thing to do. The undergraduate study program Industrial design engineering at the Faculty of Mechanical Engineering, Ss. Cyril and Methodius University in Skopje is developed in the 2004, but the design thinking as an approach was not part of any course within. The authors believe that this approach is of great importance for the students because it helps them to solve problems more creatively and at the same time it prepares them for the real challenges where the complexity of the problems that they will encounter is much higher. Since 2021, design thinking has been implemented as part of the course Research in design in the 4th year of studies and in this paper some of the student's projects are presented.

Ilstedt and Wangel (2013), have similar approach, exploring how academia and experimental design methods can contribute to sustainable future. Mickelthwaite (2022) also emphasize the importance of the designers for sustainable future.

2 Methodology

The core of this research is sustainability analyzed both as environmental and social issue. We applied the design thinking approach as methodology for this research because it has elements that are we believe are crucial for this type of research. As we said in the previous chapter it is human-centered approach that really focuses on the humans as individuals rather than consumers or customers. Another important aspect is that the process starts with problem

definition, and nobody know what the outcome and solution will be. It is iterative process, as in its core is explorative process.

The design thinking approach has five to six stages (it has different adaptation), as following: understanding (the problem), defining (the problem), ideate, prototype, evaluate and reflect. The understanding stage is the most important for us as the one that distinguishes this approach from other commonly used in design practice. In this stage the designer gains real insight into the problem: what are the causes, who are the involved parties, who are the users, what are their needs (Lewrick, Link & Leifer, 2020). The main advantage of this approach is that emphasis on the empathy. Empathy is crucial when working design with social impact and it is not something that is common in other forms of design such as product design or industrial design. When working with social issues empathy towards the community and the people is part of the design process in necessary. This way the customers become individuals that work together with the designer, co-designing. As a major part of the understanding stage are methods for observation. If done properly these methods can give so much valuable information. People are observed in their natural environment, doing their routine staff, without even knowing that they are analyzed, so they are not under pressure. There are also methods in which the researcher can ask the people to write down or even record when they are interacting with the product of interest. There are different methods that can be applied depending of the purpose of the research. In our case we applied different methods for different problems, such us: observation, shadowing, photo journal. Major part of the research was conducted during heavy COVID-19 restrictions, so most of the methods used are without lot of interaction, or if there is interaction it is outside with a small group of people. For better understanding of the problem extensive online research was conducted, analyzing what is done so far, and what can be done. Structured organization of the findings is very important because it helps navigating toward the next stage. It is also beneficial for the whole team as it helps the members to communicate easily and work towards the same goal, here we used affinity diagramming, behavioral mapping and similar methods. The ideate stage is the easiest stage for the designers, but for it to be successful all of the above stages needs to be done correctly. There are many methods that can be used for evoking creativity in the team like mind mapping, role play, but it all depends on the problem that needs to be solved and the individuals in the team. It can be very helpful in this stage to create physical prototypes, although in some cases 3D models are enough. In this stage we prototyped the interaction of the people with the products, using methods like scenarios or role play. Reflection is stage that is unique to the design thinking approach and it helps the team to see if they really succeed with the proposed solution. But it is also helpful to reflect on the work of the team and see if anything could be done different. The main idea is not to make the same mistake twice, with methods such as retrospective sailboat or lessons learned.

3 Development process

Six groups of four students were working on different social problems mentored by the authors. Each group had to choose different social problem and present it in a short brief: the problem statement, why and to whom it is important t.e. how are the stakeholders. After the initial brief we (the authors) decided which of the groups can continue working, which have to make some alteration or change the topic completely. It was important for us that the students choose the problems by themselves, thus we wanted for them to be familiar with the issue, have some connection to it or fell very strongly about it. This was important for the research, because the time was limited, the students had only four months, time not enough to establish connection and develop strong feelings and empathy, so we wanted to have head start. Further down, projects from two student groups dealing with sustainability are presented.

3.1 Project 1 – sustainability issue (too much excessive plastic)

Disposable cups and trays used for take away drinks and food are made from Styrofoam or different plastic. In recent years plastic and Styrofoam cups have been substituted with paper cups which again are lined with polyethylene in order to maintain the liquid. The problem with disposable plastic is global, the plastic production has been tripled since 1990s. About 150 million tons of plastic - many of which do not decompose - float in our oceans, according to the World Economic Forum. The Government of Canada reports that each year, about eight million tons of plastic waste enters our oceans. So by decreasing the use of plastic in our everyday life, acting on one of the UN's sustainability goals, responsible consumption and production, we can influence on many levels for preservation of the environment (smaller effect on the climate change less pollution of the waters, less energy for recycling and less waste). This means that by "small" change in the way we act as a people we can influence on few on the threatening issues for the Earth: climate action, life below water, life on land, sustainable cities and communities, (UN's sustainability goals, NA).

Through the initial research it came to our attention that the percentage of the plastic cups and trays is constantly rising and that their part in the overall plastic waste. Below some facts for USA (Earthday, 2018):

- More than 480 billion plastic bottles were sold worldwide in 2016. That is up from about 300 billion only a decade ago.
- More than half a billion plastic straws are used every day around the world.
- Over half of the world's plastic thrown out in 2015 was plastic packaging.
- Takeout orders account for around 269,000 US tons of plastic waste that has entered the oceans.
- The world uses 500 billion plastic cups every year.
- 16 billion disposable coffee cups (coated with plastic) are used each year.
- The world produces more than 14 million US tons of polystyrene each year.
  Americans alone throw away around 25 billion Styrofoam cups every year.

So the problem that this group of students was working on can be defined as "decreasing the number of disposable plastic"

Frist, extensive observation of the communities that the students live in was conducted, through various methods such as shadowing – following around without interaction, observing, taking notes, taking photographs. This was in order to learn more about the people's habits, when, where and how they are using this kind of products. The conclusion was that the number of plastic cups and coffee cups is much higher when the time is nice (spring to autumn). In this period of the year people from different ages goes to the nearby parks and picnic sites with friends for coffee or drinks. With the COVID-19 pandemic this habits have been increased. Also the percentage of people consuming take away food even in their homes has drastically risen. From the interviews that were conducted in Skopje, capital of North Macedonia it is evident that people do not have the habit of caring reusable bottles of coffee mugs. 70% of the respondents said that their bottles are too big or too heavy and even they are empty they take a lot of space. 20% of the respondents said that the reusable equipment and utensils are pretty expensive. In the interview with the vendors, when asked if they would prefer is someone comes with reusable cup or tray they responded affirmative.

After the observation and gathering information's the students used different methods in order to organize all the notions and make connections, method such as behavioural mapping, affinity diagraming and creative matrix. Since they are designers but at the same time engineers it always helps them to have a visual representation of the information but to be in a structured way.
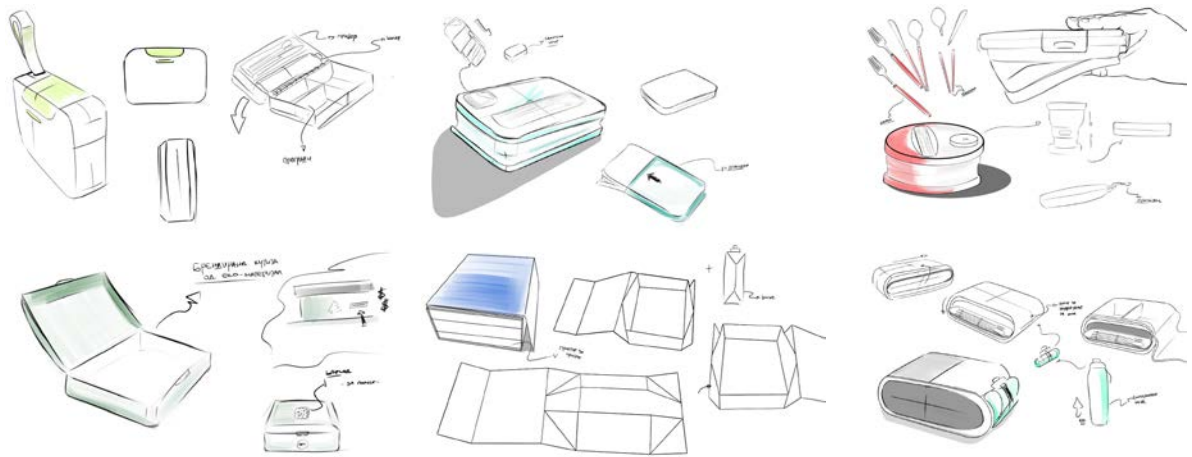
Figure 1. Inital concepts for the lunchbox

The brainstorming stage started with "How might we?" session, resulting in few interesting ideas and approaches: systems for gathering and recycling plastic, systems for refill cosmetic products, reusable bags, reusable cups and trays. In discussion sessions, we agree that is most effective if they design products that are going to be reusable. So the students decided on a complex product – lunchbox, incorporating bottle, cup, tray and eating utensils.

In the ideation phase the students focused on the small size when the product is not in use, since that was one of the main complains. In figure 1 some of the initial concepts were presented.

Students chose according to few key criteria (size, functionality, used material, number of components, aesthetics) the most appropriate concept. As part of the prototyping phase, students created various 3D model for visualization and also for evaluating its functionality. The 3D model is easy to make changes in the proportion and the visual appearance (colours & patterns). In Figure 2 the final design is presented in one colour scheme, although few colour schemes and patterns were proposed.
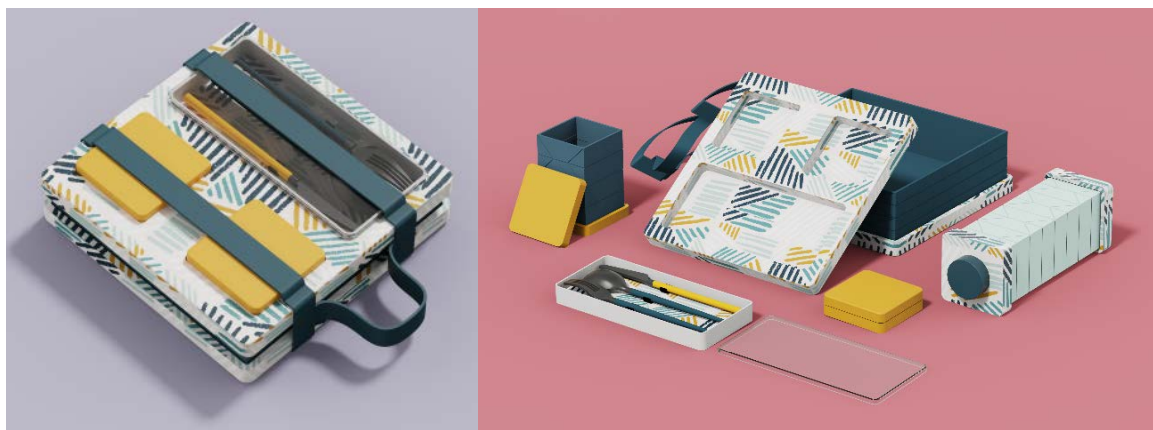
Figure 21. The lunchbox a) not in use, b) in use

The evaluation of the idea was made though physical prototypes, conducting interviews and focus groups to see how the people are reacting to the product and the whole idea. Also various scenarios were analysed, based on the information from the observations.

Eliminating plastic for everyday lives is impossible, but it can be decreased by responsible consumption & production. The designers play small role in the whole process, but someone needs to initiate. The group of students working on this project has mapped all the involved

parties and has made spreadsheet in ways of interacting with each one of them, which due to the COVID-19 restrictions are not implemented yet. First on the list are the workshop with preschool children, teaching them about the environment, why it is important to protected it and how can we protected. Also at the same time for raising awareness, providing some facts and presenting them in interesting manner through graphic of infographics and speeding them through social media. We believe if this is introduce as new contemporary way of living it can be easier to implement it. It is vital to stress the importance of this issue and to educate people in terms of the importance and necessity in taking action.

3.2 Project 2 – sustainability issue (air pollution)

With the constant technological development of the cities the pollution rises. In the developing counties the numbers are astonishing. One example is North Macedonia where few of the most populated cities are the highest ranking in the world regarding the air pollution. This was the main driving force in the work of the second group of students. They analysed statistical date in the city of Skopje, about when it cures and what are the causes. The conclusion was that the highest air pollution rates are in the winter months due to the alternative ways of heating especially the ones with lower or no income. All the other elements old cars, industry just add up to the already high number. Also what the students realise is that in the last 10 years the green areas in the city are disappearing and in their place huge buildings arise. This is very important for a city like this, that is in valley and that it does not have air convection. The definition of the problem is the following "decreasing the air pollution".

The students working on this problem first analysed the statistical data and the causes for this problem. Extensive analysis of the solutions for this problem in the world are analysed. Regarding the analysis it was decided to propose two solution that are compatible in some way. The first proposed solution was vertical garden that can be mounted on wall but at the same time stand individually. The idea for the design is to be modular that will enable to be mounted on different wall sizes and shapes. In Figure 3 initial concepts are presented. Different students have different approaches in the design process, but the modularity is the connecting element.
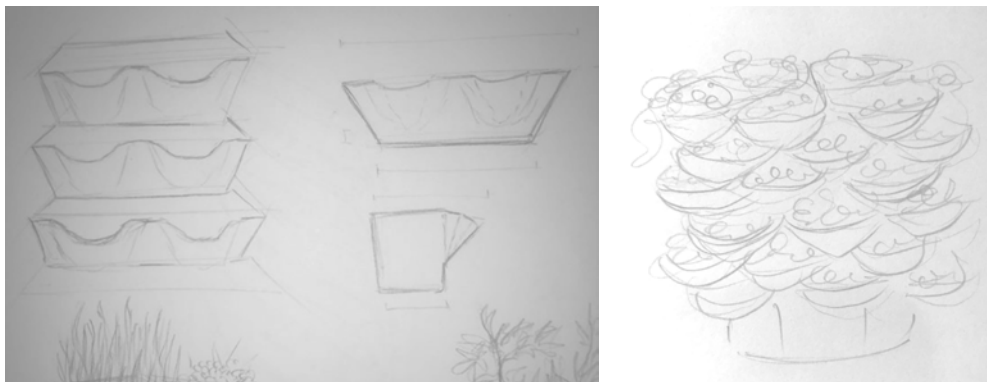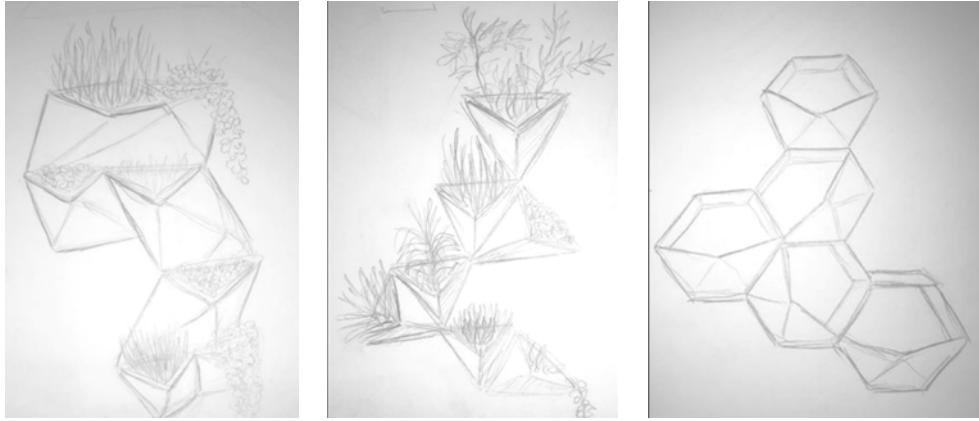
Figure 3. Initial concepts for the vertical garden

The conducted interviews and surveys reveal that the people are in the proposed solutions because all of them are feed up with lack of greenery in the urban areas. Additionally, questions if they would want this kind of greenery on their houses or buildings. The elderly welcomed the idea of the second solution. Because they can go for a wall or just sit with their friends without the need of leaving the building. The approach for the second solution was simplistic involving as much greenery as possible. For the proposed concept one particular building in the center of the city was chosen. The residents of the building were involved in all the stages of the process and most of their ideas and suggestions were implemented.
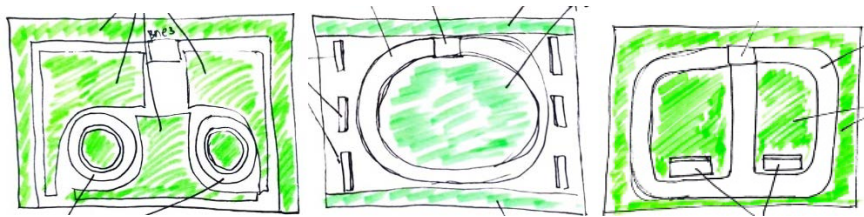
Figure 4. Initial concepts for the rooftop parks

The 3D models were used for better visualization and to discuss the ideas with the residents. Focus group was performed in order to discuss the possible solutions and to choose the final concept (Fig. 5).

Figure 5. Final concept solution

These solution are just small step in reducing the air pollution, but if the city officials get involve and this becomes a norm the result can be more significant. At the same time the vertical garden have effect of raising awareness among the population.

4   Discussion

The reflection of the conducted analysis through student projects is the most important for us as researches but at the same time professors. Implementing this approach into the Industrial design engineering study program for the first time we were a bit hesitant. However the students were working very hard and at the same time enjoying in the work. We made some mistakes in the implementation where we had higher expectations from the students for some tasks, but we resolve that through communication.

We conducted reflection session with the students, using the methods lessons we learned. And from this method it turns out that the students gain a lot from this approach, not only in knowledge but also in working ethics, team work, sharing and discussing ideas, and empathy in the working process.

5   Conclusion

The design thinking as an approach for problem solving that is widely used in the academia but in our country that is not the case, which has to change. The ability to learn through the process while working on an open end problems it is very encouraging for the students. At the same time it forces them to research to go deep into the problem but also looking at the big picture, which can result as new and innovative products. Then the aspect of reflecting as one of the most important in the academia is part of this approach.

Application of the design thinking for the sustainable design is completely justified. The empathy is key element that makes this approach useful in this kind of situations. The main problem that we encountered is that the period of 15 weeks is too short to conduct the whole research and implement the solutions. This can be resolved if the project be conducted throughout the whole academic year.

For the further research we will try to give predefined problems to the students, with arranged cooperation's with institutions and all involved parties in order for the students to concentrate on their work and implementation of the proposed methods.

Acknowledgement

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