Contribution of Futures Studies to Industrial Design Studio Education

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ABSTRACT

Designers should keep up with the pace of change and have the power of directing change to the desirable. In order to design forward product/services in a continuously changing world, designers should have "future vision". Futures Studies is considered a practical way to help designers develop the capacity for future vision. The main research problems in this study are; what kind of problems do students confront when they undertake future oriented design projects? and how can the implementation of futures research methods in studio education be beneficial for design students?

Keywords: Industrial Design, Futures Studies, Design Education, Future Oriented Design

A BRIEF DISCUSSION ON THE RELATIONSHIP BETWEEN INDUSTRIAL DESIGN AND FUTURES STUDIES

Since the industrial revolution, the development of technology has advanced rapidly and these developments have brought social, cultural and economic changes. Futurist Kurzweil (1999), inspired by Moore's Law, suggests "The Law of Accelerating", according to which the rate of change in a wide variety of evolutionary systems tends to increase exponentially. Raskin et al (2002) propose that historical transitions occur more rapidly than natural evolutionary transitions and change accelerates in a regular fashion. From a sociological perspective to the rate of change, Toffler (1981)mentions the need for society to keep up with the pace of change, not to experience a 'shock effect'. To keep up

with the pace of change, to build foresight and to help guide decisions, the discipline of Futures Studies and scientific futures research methods have been used since 1940s.

Industrial design has also been affected by rapid changes and paradigm shift occurred in the profession (Cross, 1981). Definition and scope of the profession has shifted. Broadbent (2004) remarks that in a world seemingly committed to more complex systems, design science should adapt itself to keep up with wicked problems. Designers, therefore having future vision can look at designing process more systemically, and bring cultural, economic, political and environmental perspectives to the design process.

Krippendorf (2006) quotes from Edwards (1999), Lukas (1998) and McMath (1998) in his book *Semantic Turn*, stating that 80% of all new products fail on launch, and another 10% fail within the next five years. Products designed in accordance to just today's needs and requirements stay behind the pace of change until reaching end-users. Industrial design, as a future shaping discipline ((Jonas, 2010); (Seymour, 2008)), needs future vision to update itself, to be able to analyze the needs of society and systems, to use foresight to identify potential changes, and to design positive futures for the system ((Cross, Elliott, & Roy, 1975);(Evans & Sommerville, 2007); (Bevolo & Brand, 2003)).

Design researchers Evans and Sommerville (2005), Jensen (2005) and Ratner (2007)propose that designers must develop future vision in the course of undergraduate education and those futures thinking should be incorporated into the curriculum.
Future vision can be embedded into the curriculum with elective or compulsory courses (under course titles such as 'Future Oriented Design'); it may also be given through the 'Project' courses which are the main courses of the discipline. 'Future oriented design' is a common theme or topic at many universities (examples can be seen at Politecnico di Milano, Design Academy of Einhoven, Royal College of Arts, Icesi University, University of Central Lancashire and University of Salford.).

In this paper, we will examine theproblems faced by students during the Future Oriented Design Projects and the contribution of futures research methods in industrial product design studio education.

THINKING ABOUT DESIGN

Much research has been done since the 1960s to understand what designers do and how they think. The work of Rowe (1987), Cross(2006) and Lawson (2005), attempts to describe and demonstrate the thought processes of designers in action. In order to

analyze the thought process of designers, researchesbegan with study of the nature of design problems. Rittel generated the term 'wicked problems' in the 1960s, arguing that designers deal with wicked problems that are "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Buchanan, 1992).Simon (Simon H. , 1973) indicates that, the problems presented to problem solvers are regarded as ISP (ill defined problems) and they can become WSP (well defined problems) only in the process of being prepared for the problem solvers. According to Simon, the designer working on a problem will start in an ill structured state and convert it, within time, through evocation from memory into a well structured problem.

Schön (1984) suggests that designers reflect in action on the construction of the problem. Designers treat the design case as unique and instead of applying standard techniques, found the case problematic and frame it. Designer's unintended changes give the case new meanings and moves the design process. Evaluation of the new meanings create new criteria and designer reframes the case again.

Cross (2006) remarks that design problems do not contain all the necessary information intrinsically and do not have a guaranteed 'correct' solution. According to Cross (2006) a solution-focused strategy is clearly preferable to a problem-focused one. It will always be possible to go on analyzing 'the problem', but the designer's essential task is to produce 'the solution'. Therefore design is not a search for the optimum solution to the given problem, but it is exploratory. The creative designer interprets the design brief not as a user guide for a solution, but as a kind of partial map of unknown territory. In order to cope with ill-defined problems, designers have to learn to have the self-confidence to define, redefine and change the problem-as-given in the light of the solution that emerges from their minds and hands (Cross, 2006).

Cross defines five aspects of 'designerly ways of knowing' (2006):

- Designers tackle 'ill-defined' problems
- Their mode of problem-solving is 'solution-focused'
- Their mode of thinking is 'constructive'
- They use 'codes' that translate abstract requirements into concrete objects
- They use these codes to both 'read' and 'write' in 'object languages'

Some aspects of design ability have been codified into 'design methods' to generate solutions to design problems (Cross, 1989). Design methodologists aimed to pinpoint

distinctions between design and science but still the use of design methods was regarded as disruptive by a community. The use of design methods was long a subject of debate, but now researchers remark that a systematic approach can be helpful to students in design education (Radcliffe & Lee, 1989). Design students need to develop a strategic approach to the overall process, based on some simple but effective techniques or methods (Cross, 2006).

THINKING ABOUT FUTURES

The very notion of researching the future is a paradox. The word *research* lies within the time boundaries of the past and present so to do research on the future appears a logical impossibility (Saurin, 2012). As well as being a paradox, futures studies do not have any clear definition or a framework. There are different perspectives in the area of researching the future/futures (even using the future or futures is a debate). Over time, various definitions have been made by different schools such as futurology, futuristics, futurism, futurology, foresight, futuring, technology forecasting, futures research, futures studies, strategic foresight, visionary management….(Sardar, 2010). This study is concerned with the field of Futures Studies. The purpose, aim and definition of Futures Studies vary from author to author. Henry David (1970) proposes that: "futures research may be defined as 'the intellectual form in which a society renders account to itself of its probable and possible futures".

Some futurists define the concept with action. Glenn (1994) describes it as "to systematically explore, create and test both possible and desirable futures visions". Bell (1997) states that the purpose of futures studies is to discover or invent, examine and evaluate, and propose possible, probable and preferable futures. Amara (1981)defines it as an exploration of possible, probable and preferable futures. Inayatullah's definition is similar but expanded in a critical manner as "Futures studies is the systematic study of possible, probable and preferable futures including the worldviews and myths that underlie each future" (2013). All place emphasis on actions or processes, using verbs such as *explore*, *create*, *discover*, *exploration*, *invent*, *test*, *examine* and *evaluate*. Products for action-oriented futures include both possible and desirable futures. For other futurists, the ultimate goal often involves ethical issues surrounding mankind, society and, often, the have/have not gap (Masini, 1993)(Theobald, 1997). Major authors reveal different frameworks for futures studies. These are shown in the following table.

Table 1.Futures Studies Frameworks of Several Authors

Author	Futures Studies Frameworks				
Slaughter **(1993)**	Pop Futurizm	Problem Oriented	Critical		Epistemological
Kuosa **(2011)**	Creative Future Images	Planning and Decision Making	Dealing with Global Questions		
Inayatullah **(2002)**		Predictive	Interpretive	Critical	Participatory
Saurin **(2012)**		Positivist	Constructivism	Critical	Participatory

Frameworks have common classifications (for example Slaughter's problem oriented framework is similar withKuosa's planning and decision making, Inayatullah's predictive, Saurin's positivist framework).

Industrial design is related to all frameworks in some way. General Motor's advertisements on the future (Design for Dreaming, 1956) or Syd Mead's Light Cycle design for science fiction film *Tron* can be associated with pop futurizm and creating future images. Both are attractive images of the future/future products, produced to support a further idea.

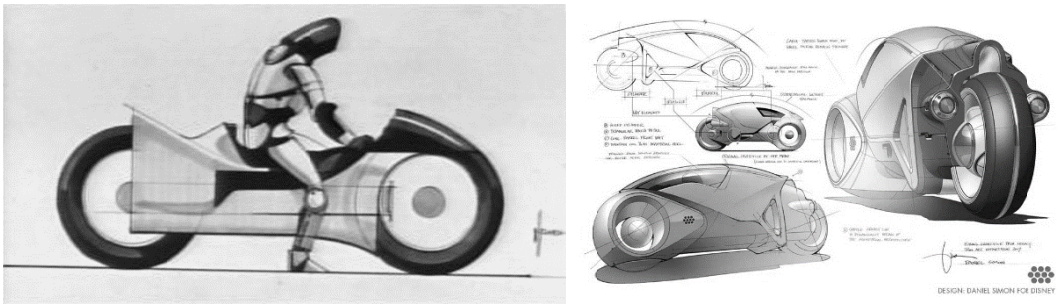

Figure 1. Syd Mead's Light Cycle Design (Simon D. , 2011) and Daniel Simon's Reinterpretation (Arek, 2011)

The process of building and design of British Airports Authority's Terminal 5 at Heathrow Airport lasted for 50 years. In this long-term project, to reduce economic, social, cultural and environmental risks BAA used design and foresight to understand the future user experience. This strategic design approach can be associated with problem-oriented, planning and decision making, predictive and positivist frameworks.

Figure 2. BAA's Terminal 5 at Heathrow Airport (DFFN, 2003)

Another example is Whirlpool Project F aimed to explore the future of fabric care in the next ten years and how this might affect manufacturing of major domestic appliances for Whirlpool. They examined nanotechnologies, waterless washing for cleaning future types of fabrics, and environmental and ecological concerns, especially about energy consumption and water conservation (DFFN, 2003). Deconstructive and reconstructive aspects of the Whirlpool Project F design process resembles critical, global questions, constructivist and participatory frameworks.

Figure 3. Biologic Design, from Project F (DFFN, 2003)

The aim of this article is to show the influence of future vision on industrial product design students in design education, so Pop Futurism or Creating Future Images is not eligible to embed future vision; however it can be regarded as an exercise for the future. Problem oriented, planning and decision making, predictive or positivist frameworks include more technical research methods better suited to product-oriented futures studies. Critical, interpretive and constructivism frameworks involve complexity and

multiple tasks, and can be considered more suitable for embodying future vision in industrial design education. Therefore this study comprises interpretive, constructivist and critical epistemologies.

Critical Futures Studies

According to Ramos (2003), critical futures studies can be understood as studies of futures that take as a primary consideration of the analysis and reformulation of the way we know our world, worldview and the social construction of reality.

Notable researchers in critical futures studies are Sohail Inayatullah and Richard Slaughter. Inayatullah (2013) defines the aim of the approach asnot prediction or comparison but as making the units of analysis problematic, to undefine the future. According to Slaughter, critical futures studies are the basis for emancipatory social innovations and creativity for cultural renewal. Slaughter's critical futures is not about 'blueprints' for the future, but about opening up spaces to alternative epistemes, cultural worldviews and discourses, and hence about opening up pathways to substantively alternative futures beyond what's currently offered through mainstream 'pop' and 'problem oriented' futures work, scenarios and the like (Ramos, 2003).

Slaughter and Inayatullah met in 1986 and shared their perspectives on critical futures studies. Inayatullah borrowed the word "Litany", from Slaughter and created the method Causal Layered Analysis; a method that fits Critical Futures Studies well.

CLA – Causal Layered Analysis

Causal Layered Analysis (CLA) is a method created by Sohail Inayatullah during his academic studies between 1975 and 2000. Inayatullah's first inspirations came from the tension between the empiricist and poststructuralist academics at University of Hawai's Department of Political Science. From the influences of Galtung, Foucault, Sarkar and Slaughter, CLA was formed (Inayatullah, 2004).

CLA's aim is not predicting the future but creating transformative spaces for the creation of alternative futures. Causal layered analysis consists of four levels:

- The litany: Official unquestioned view of reality
- Social causes: The systemic perspective. The data of the litany is explained and questioned at this level.
- Discourse/worldview: Deeper, unconsciously-held ideological, worldview and discursive assumptions are unpacked at this level.

- Myth/metaphor: This level provides a gut/emotional level experience to the worldview under inquiry.

CLA is best used in conjunction with other methods such as emerging issues analysis, scenarios, backcasting and visioning. In this article, to compose a set of methods within CLA, Inayatullah's Six Pillars approach was examined.

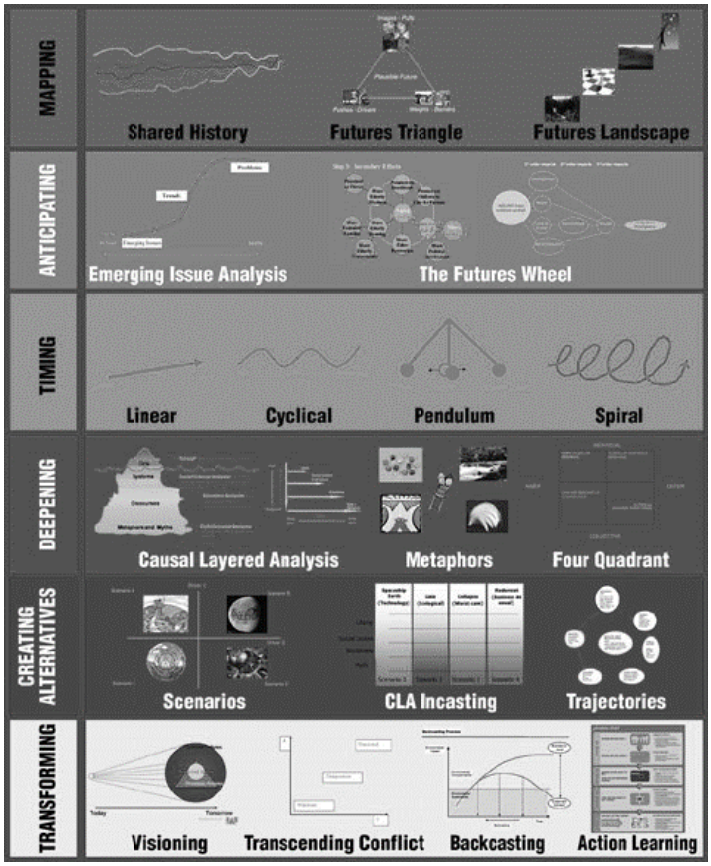

Figure 4. The Six Pillars Approach (Inayatullah, 2008)

According to Inayatullah (2008), the Six Pillars approach provides a theory of futures thinking that is linked to methods and tools, and developed through praxis. The pillars are: mapping, anticipation, timing, deepening, creating alternatives, and transforming.

Mapping and timing levels are exploratory levels, aiming to develop information on history and reflecting it to future forecasts. The anticipating, deepening and creating alternatives levels consist of methods effective in the future oriented design projects. The Futures wheel (Anticipating pillar), CLA (Deepening pillar) and scenarios (Creating alternatives pillar) are methods selected from Six Pillars and contribution of methods into design process analyzed.

Futures Wheel

The Futures Wheel is a kind of structured brainstorming for organizing thinking and questioning about the future. It was invented in 1971 by Jerome C. Glenn. It has also been called as Implementation Wheel, Impact Wheel, Mind Mapping, and Webbing. The name of a trend or event is written in the middle of a piece of paper, then outcomes are drawn wheel-like from the center. Primary outcomes are written to first circles. Secondary outcomes of each primary outcomes are written to the second ring of circles. This continues until a useful picture of the implications of the event or trend is clear.

The Futures Wheel is most commonly used to:

- think through possible impacts of current trends or potential future events;
- organize thoughts about future events or trends;
- create forecasts within alternative scenarios;
- show complex interrelationships;
- display other futures research;
- develop multi-concepts;
- nurture a futures-conscious perspective; and
- aid in group brainstorming (Glenn J. C., 2003).

Double Variable Scenario Technique

Glenn (1993) describes scenario method as the story that connects a description of specific future to present realities in a series of causal links that illustrate decisions and consequences. The purpose of scenarios is to systematically explore, create, and test both possible and desirable future conditions. The method does not have exact usage information, because there are multiple scenario techniques. In this study, the double variable scenario method was used for easy usage and lucidity.

The aim of the double variable scenario method is to develop scenarios from two key uncertainties. The method can be implemented as follows

1. First select the year, for example, 2035
2. What is the key question you wish you knew the answer of?
3. What are the critical uncertainties? Select two.
4. Use the two uncertainties to create a double cross
5. Articulate four different scenarios based on the uncertainties
6. Develop the scenarios. (Inayatullah, 2013)

IMPLEMENTATION OF FUTURES RESEARCH METHODOLOGY

In order to analyze the problems that students face upin a future oriented design project, and to propose a futures research methodology to report their contribution, an

implementation study was carried out in 2013-2014 Spring Semester at Dogus University's Department of Industrial Product Design. The study was conducted with 25 students in 5 groups. None of the students participating in the study ever had ever done a future oriented design project and it was a new experience for all. Project courses in the Department of Industrial Product Design, comprise 2 sessions of 3 hours per day (6 hours per week) over a period of 14 weeks. The implementation study was conducted in a total of 7.5 weeks in two phases.

The 1st Phase focused on observing the students' approaches to a future oriented design project, so non-intervention period was applied to this phase. For the 2nd Phase, students were introduced to a specific Futures Research Methodology (Futures Wheel, Causal Layered Analysis and Double Variable Scenario Technique) and the contribution of methodology was observed.

A conceptual and broad project brief as 'Designing Leisure Time Products of Future' was given to students to enable them to generate solutions to problems they first had to identify.

1st Phase: Non-intervention period

In this phase, the project brief and topic was announced and concepts are discussed with students. Following the presentations, five student groups were formed by teaching staff. The non-intervention period continued for 3 weeks. In this phase, project groups gathered together, and they were asked to present their sketches and were given critiques.

Preliminary Assessment

Implementor teaching staff should evaluate all group members' work individually, talk with all members. This evaluation process and presenting projects will also keep students interest to design project alive (Hocaoğlu, 2015). Hence, on the last day of thenon-intervention period, preliminary assessment was made with all groups, and ideas were collected about projects and project processes.

2nd Phase: Implementation of Futures Research Methodology

CLA, Futures Wheel and Scenario methods were introduced to students and groups implemented these methods on their project. The process was recorded with camera, audio record, personal notes and sketchbooks.

CLA was demonstrated to students. Following implementation of CLA, groups were assigned to implement Futures Wheel and Double Variable Scenario methods. The data gathered from CLA was used by the groups with the Futures Wheel and this helped to identify the key concepts for each project. Each group chose 2 dominant key concepts from the Futures Wheel and used them to create 4 different scenarios. The groups were then asked to choose one scenario or create one scenario by combining two scenarios. Students created a story out from the final scenario and visualized it with creative techniques.

Survey Study

In order to collect the opinions of students and teaching staff on the pilot study process, survey study was conducted. Teaching staff and students were asked to answer a set of open ended questions about the use of futures research methods in the project.

CONTRIBUTION OF FUTURES RESEARCH METHODOLOGY

The findings of the content analysis of preliminary assessment, implementation of the Futures Research Methodology, and the questionnaire results of teaching staff and students, are gathered together.

In the 1st Phase no methods were implemented and the non-intervention period followed. At the end of Phase 1, preliminary assessment was done to understand the advantages and disadvantages of the process, and the challenges students face.

Difficulties faced by students during the 1st Phase

Students:

- could not define potential, probable or preferable futures
- felt uncomfortable on studying with the future
- found the future concept limitless and hard to handle, so could not start the project
- put forward ideas about futures but couldn't combine them and create scenarios
- were afraid of not being able to forecast the future exactly so tended to create 'realistic' design ideas
- do not see themselves as a member of future-shaping discipline, so they follow existing trends and technologies
- could not define a time-frame for future scenarios
- could not determine criteria for design
- inspired from their own needs/wants of today and created possible future scenarios with these criteria
- fell into the mistake of designing extraordinary things.

- created their design ideas within tools, technologies and events in place of concepts
- failed to develop a holistic view

Following the implementation of CLA, with the exception of Group D, all groups started to create alternative project ideas, inspired from social, global contexts and metaphors. (Three groups were inspired by proverbs and one group was inspired by a quotation of Karl Marx). Groups adopted the Futures Wheel and Double Variable Scenario methods and implemented them several times.

A broad assessment was made with the results of Preliminary Assessment:

- *Students couldn't define the potential, probable or preferable futures*
  Inspiring from their own wants and needs or technological developments students were reaching potential or probable futures; but couldn't imagine to reach preferable futures or integrating it with potential or probable futures. Within methodology they have noticed the difference.
- *Students felt uncomfortable on studying the concept of the future.*
  The future is the unknown space so students hesitated to study it. Following directions and composing scenarios step by step helped students to overcome their fear.
- *Students found the future concept limitless and hard to handle, so they couldn't start the project.*
  With CLA, students found ways to gain deeper understanding for their project; but were still uncomfortable when talking about the future.
- *Students put forward ideas about the futures but couldn't combine them and create scenarios.*
  Using the Futures Wheel and Double Variable Scenario methods helped students to associate ideas and create more inclusive scenarios.
- *Students were afraid of not being able to forecast the future exactly and tended to create realistic design ideas.*
  Students were mostly anxious at the beginning of the implementation but their confidence and motivation increased as the process progressed.
- *Students don't see themselves as a member of a future-shaping discipline, so they follow existing trends and technologies.*
  According to them, the future is created by technology and technology is created by engineers, so following technological innovations can help designers forecast the future. The most-used concepts at the project idea generation process were visual reality, simulation, holograms, games and sport. During implementation, students managed to eliminate their prejudices and created their own alternative scenarios. But after implementation, some groups limited themselves with technological data at the design development process.

- *Students couldn't assign a time-frame for the future scenarios*
  Students were confused without a clear time-frame. The project topic given was broad - "Designing Leisure Time Products of Future" – and a time-frame was deliberately not given to see the reaction of students; but students were confused and spent time by discussing a time period. This finding suggests that giving a clear time-frame as part of the project brief can be more effective.
- *Students couldn't determine criteria for design*
  With the Futures Wheel, students observed positive and negative outcomes of the concept and within these outcomes managed to create alternative scenarios.
- *Students were inspired by their own needs /wants of today and created possible future scenarios upon these criteria.*
  A clear majority of students drew inspiration from their own experiences and could not create alternative project ideas. Group D did not do the Futures Research Methodology and insisted on the project idea they created in the 1st Phase of implementation. They met with difficulties on developing their project idea. Other groups managed to create alternative future scenarios. With CLA, students were able to take a broader perspective and learned to examine the concept in every aspect.
- *Students fell into the mistake of designing extraordinary things.*
  This perspective has continued in some groups. It was determined that groups which gained deeper understanding of the topic and specified outcomes better, would overcome this problem better.
- *Students created their design ideas using tools, technologies and events in place of concepts.*
  They found it difficult to think in the abstract; but they did got used to working with CLA. Teaching staff can provide support in the process.
- *Students failed to develop a holistic view.*
  Students were prone to thinking in accordance with certain criteria, and fail to notice cultural, political, environmental, economic factors; this aspect can be improved by experience.

According to the results of survey study teaching staff found the futures research methodology appropriate to embed futures concepts in the preliminary stages of the design process. Students had problems on identifying design problem and CLA method made it more identified with its deepening approach. Futures wheel method reframed the data obtained from CLA method and helped students to see key codes for the project. Scenario method transformed the abstract requirements of the project to concrete objects.

The study shows that 40% of students would like to use methodology in other projects; 48% of students think they will use some part of the methodology in their later projects; 12% of students would not like to use methodology again. Students who said they would use methodology again gave justifications:

- *Developing project easier with layered research structure*
  Designers tackle 'ill-defined' problems so framing the design problem is a practical way to cope with complex design problems as in this project. Layered structure of CLA and Futures Wheel advanced student's framing capability.
- *Makes the statement more understandable*
  Framing design problem capability develops with advance; so novice design students do not have enough experience for framing. Progressive structure of methods de-stressed students and helped to frame and develop design problem.
- *Positive aspects are: developing creativity in a natural way*
  Designers use 'codes' that translate abstract requirements into concrete objects. Novice design students can obstruct in translating abstract requirements into concrete objects. Scenario method assist students to make sense of abstract requirements and associate them to concrete objects.
- *Because I want to think in a wide range and make comprehensive research*
  Designers has to collect codes from a wide range and their constructive thinking mode support studying with complex data.
- *They allowed me to see every detail which I could miss*
  CLA method supported students to question the known and to see varied aspects of the design problems. Particularly myth/metaphor level assisted students to develop a new understanding.
- *Possibilities that I haven't thought of can occur*
  Layered structure of the methodology developed their constructive thinking. The relation tree of outcomes in futures wheel method, break down the prejudices of students about the design topic.
- *It helps to compose ideas, I can design more easily*
  Designers' mode of problem-solving is 'solution-focused'. CLA and Futures Wheel methods helped to create abstract codes easier and scenario method transformed them to design ideas.
- *It discovers the actual wants and needs of people*
  As Simon states, the designers will start the design problem in an ill structured state and convert it to well defined stage. During this process the problem will be re identified. Interrogator structure of the methodology helps the student to identify the problem better.

CONCLUDING REMARKS

Industrial Design, as a future shaping discipline, needs 'Future Vision' to update itself, and be able to analyze society's, system's needs, long-term changes facing society, and to design positive futures for the system. Future oriented design projects at undergraduate design classes are beneficial to gain this vision.

In this study two different types of data were obtained on future oriented design projects in undergraduate design classes. The first group of data is the difficulties the students faced with the future oriented design projects during the non-intervention period; the second group of data shows the variables observed after the methodology was implemented.

The implementation of the futures methodology indicates that it helped students cope with uncertainty and complexity in future oriented design projects. Positive and productive results were obtained with the methodology used in the 2nd phase of the study. For further study on this topic, contribution of varied futures methods/methodologies can be researched.

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