

**UNDERSTANDING THE EFFECTS OF COGNITION
IN CREATIVE DECISION-MAKING:
A CREATIVITY MODEL FOR ENHANCING THE DESIGN STUDIO PROCESS**

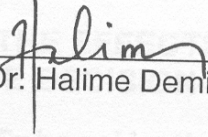
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By

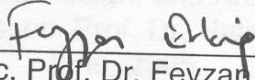
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June, 2005

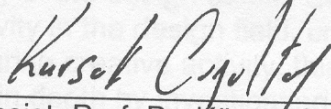
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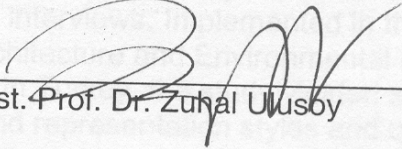
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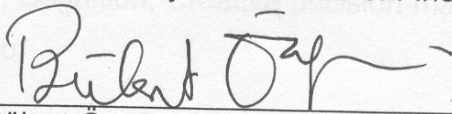
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ABSTRACT

UNDERSTANDING THE EFFECTS OF COGNITION IN CREATIVE DECISION-MAKING:

A Creativity Model for Enhancing the Design Studio Process

Deniz Hasırcı

Ph.D. in Art, Design, and Architecture

Supervisor: Assoc. Prof. Dr. Halime Demirkan

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The demand for creativity is a significant concern in all educational environments, especially in institutions of design. Considering this, the study aspires to improve creativity in the design studio. Based on the theories and research addressing creativity in the design field, creative decision-making, and cognitive processes during creative activity, this study analyzes the creative process of design in depth by investigating the characteristics of the decisions made through the stages of the process, and means of supporting those decisions for the main purpose of enhancing academic and professional creativity. The study establishes its basic framework by combining two different models: '4P's' of creativity by Rhodes and the 'Five Stages of the Sensational Thinking Model' of O'Neill and Shallross (5R's), and makes use of the methods of protocol analysis, observation, product assessment, and retrospective interviews. Implemented in the third year design studio in the Interior Architecture and Environmental Design Department, Bilkent University in Turkey, the study yielded significant results on preferred imagery and representation styles and quantity, time spent at different stages of the process, underdeveloped skills, behavior, in addition to student-student and student-instructor relations, and associations between creative processes and products. Moreover, constructive interaction between students was observed to be helpful in developing their ideas, and students who have used more imagery were detected as more creative. A model was proposed to understand the creative process and test the hypotheses, refined according to the study, and presented in a way to be readily utilized or adapted to various situations.

Keywords: Creativity, Cognition, Creative decision-making, Design process, Design studio.

ÖZET

YARATICI KARAR VERMEDE BİLİŞİN ETKİLERİ: Tasarım Stüdyo Sürecini Geliştirmek İçin Bir Yaratıcılık Modeli

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Yaratıcılık, her tür eğitim ortamında gerekli olan önemli bir ölçüt olsa da, tasarım eğitiminde en uç noktaya ulaşır. Bu düşünce çerçevesinde, bu çalışma tasarım stüdyosunda yaratıcılığı geliştirmeyi amaçlamaktadır. Tasarım stüdyosunda yaratıcı düşünceyi ve ürünü desteklemenin amacı, verimli bir tasarım eğitimi oluşturarak sonuçların profesyonel hayata yansımaları sağlamaktır. Bu çalışma, tasarım alanında yaratıcılık, yaratıcı karar verme süreci, ve yaratıcı etkinlik sırasındaki bilişsel süreç konularındaki teori ve araştırmalara bağlı olarak, tasarım alanındaki yaratıcı süreci incelemektedir. Amaç, yaratıcı süreç sırasında alınan kararların özelliklerini anlayarak desteklemek ve buna bağlı olarak akademik ve profesyonel yaratıcılığı geliştirmektir. Çalışma, temel çerçevesini iki farklı modelin bir araya getirilmesiyle oluşturmuştur: Rhodes'un 'Yaratıcılığın 4P'leri' ve O'Neill ve Shallcross'un 'Beş Aşamalı Duyarlıklı Düşünce Modeli' (5R'ler), ve protokol analizi, gözlem, ve retrospektif mülakat metodları kullanılmıştır. Bilkent Üniversitesi, İç Mimarlık ve Çevre Tasarımı Bölümü'nde 3. sınıf öğrencileri üzerinde uygulanan araştırma, öğrenciler tarafından tercih edilen akılda canlandırma ve betimleme yöntemleri ve miktarları, sürecin farklı aşamalarında geçirilen zaman, yeterince gelişmemiş beceriler, davranışlar, öğrenci-öğrenci ve öğrenci-öğretmen ilişkileri, ve yaratıcı süreç ve ürünler arasındaki ilişkilere yönelik önemli bulgular elde etmiştir. Ayrıca, öğrenciler arası yapıcı iletişimin fikirlerin gelişiminde yararlı olduğu ve akılda canlandırmayı daha fazla kullanan öğrencilerin daha yaratıcı olduğu bulunmuştur. Yaratıcı süreci anlamak ve hipotezleri sınamak için bir model önerilmiş, çalışmaya göre geliştirilmiş, ve benzer veya farklı durumlara uyarlanarak kullanıma hazır hale getirilmiştir.

Anahtar Sözcükler: Yaratıcılık, Biliş, Yaratıcı karar verme, Tasarım süreci, Tasarım stüdyosu.

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1. INTRODUCTION

It is significant, yet difficult to understand the cognitive process of creative decision-making that leads to creative results and products. If one had the possibility of being able to get even a glimpse of the thought processes that take place in the human brain, this would be a spectacular discovery leading to revolutionary modifications in various fields, sciences, and education. In the design field, where there is a great deal of creativity involved and there are less boundaries regarding methods, it is even more difficult to understand the course that leads to a creative product.

However, it is crucial to understand creative decision-making process for the purpose of improving products both in education and practice. Moreover, the acquired information can be helpful in improving educational methods in design institutions. This study aims to understand the process of creative decision-making and propose a creativity model for enhancing the design studio process.

Based on the theoretical issues regarding creativity and cognition, this study is based on a framework focused on design studio process. In this introductory chapter, a detailed problem statement, and the aim and scope of the dissertation are given. Subsequently, the context, and the structure of the study are outlined.

1.1 Problem Statement

Based on the theories and research addressing creative decision-making and cognitive acts during design process, the study analyzes the design process in depth. The characteristics of the decisions made during the stages of the process, and means of supporting these decisions for the main purpose of enhancing academic and professional creativity is sought.

1.2 Aim and Scope

The demand for creativity is a significant concern in all kinds of educational environments. Moreover, this need reaches a climax in institutions of design. Considering this, the study aspires to improve creativity in design studio. The purpose of enhancing creative thought and products in design studio is to provide an effective design education with results that are expected to be extending well into professional work.

Although students are taught about what is right and wrong, what is creative and not creative during design education, not much information is given to them on how they should carry out the creative process of design. This is mostly done so as not to precondition or hinder creative activity. However, students may benefit largely from a process that will more efficiently lead them to results that fit a more distinct definition of creativity. Clarifying the definition may seem to hinder or obstruct creativity, but in fact it is necessary as the creative processes that lead to creative products fall within a rather narrow range.

Since we expect results to answer the needs of a certain task and solve a problem in an appropriate way, we are already expecting the creativity to take place in a framework with flexible borders. Thus, the idea of creativity caused by muses coming out of nowhere can be abandoned for a more deliberately applied sequence of events that may lead to creativity. The question is if creative design takes place in a particular sequence in everyone and if so, whether it can be enhanced in terms of quality as well as time or not.

Understanding how designers think, make decisions, and solve design problems is significant for both theoretical and practical purposes. The study aims to understand the 'cognitive process of creative experiences', with a focus on 'creative decision-making' during the process of design. This explanatory section of the study is followed by the investigation of an answer for the question, 'What are the characteristics of the process of creative experience, what can be stated about how we use this information to support it in order to enable obtaining results or products that are creative?'

It is important that a more systematic approach should be brought to creative processes of others as problems frequently arise in open-ended self-reports that have been used in studies in this area. Moreover, most stages (i.e. incubation which is an internal stage) that comprise the process are not always open to self-introspection due to the diverse array of techniques used by different persons and lack of systematic approaches (Verstijnen et al., 1998; Simonton, 2003; Kristensen, 2004). Thus, a systematic combination of

findings derived from the observer, instructors, and self-assessment have been utilized in this study.

This study is primarily qualitative, but is supported greatly by quantitative data. Findings obtained through 'observation', 'product assessment', and 'protocol analysis' ('retrospective interview') are used in order to develop a model to enhance creativity.

1.3 Context

The study relies on the idea that creativity can only become recognizable if there exists an interrelation of the 4P's (Mooney, 1963; Isaksen et al., 1993a; Jones, 1993). Rhodes defined the 4P's as the creative 'person' (the person who creates), 'process' (the process of creation), 'product' (the product that is a result of the creative process), and the 'press' or environment (environment, context, or situation in which the creative act takes place) (as cited in Firestien, 1993). Most of the previous research on creativity focuses on the creativity of the product rather than the process (Ebert II, 1994). However, emphasis must be placed on the creative process that actually *leads* to the product. In addition, there is a need to target the creative process for more efficient results (Isaksen and Dorval, 1993).

Among others, Guilford (1967) and Sternberg (1988) stated that, the cognitive processes underlying creativity should be investigated in order to understand creativity. Among all sorts of investigations regarding creativity, there is a shortage in the number of studies that investigate the stages within the creative process –one constituent of the 4P's that are necessary to fully

define creativity. Additionally, there are not many studies that look into topics concerning the understanding of the creativity-setting relationship (the situations or conditions that enhance and promote creative decision-making).

Creativity is not defined clearly and wholly in several studies despite the necessity to do so due to different understandings of the topic. It is mostly combined with another characteristic or ability such as, 'solution quality' (Kruger and Cross, 2004), thus making it difficult to work on one aspect independently from the other. What complicates matters more is that, the criteria according to which creativity is assessed are not clear in many studies as Edmonds (2000) and Dorst and Cross (2001) have stated, whereas they should be. Relying on individual assessments of judges - however consistent they may be- makes it difficult to replicate and thus, generalize the results of the study.

In a study that preceded and was the inspiration source for this present one (Hasirci, 2000), the focus was on the interaction between the 'creative person', 'creative process', and 'creative product' inside a creative environment (see also Hasirci and Demirkan, 2003). Simonton (2003) stated that, creativity has three essential components -persons, processes, and products- and they should all be investigated for a complete notion of the concept, otherwise, instead of the "forest" of creativity one can only see "singular trees" without the picture of the whole (p. 490). This study, however, considers these elements, but delves deeper into the creative process. This approach has supported the creativity-enhancing physical and social

measures in the learning environment that were dealt with in the previous study (Hasirci and Demirkan, 2003).

This study analyzes the cognitive stages in the creative decision-making process during the act of designing. It also examines the connection between cognitive issues and tasks related to the third dimension of objects and spatial issues in interior architecture. The stages of the creative process are examined, exploring the creative design processes of students of the Department of Interior Architecture and Environmental Design at Bilkent University in Ankara, Turkey. During this procedure, the reinterpretation and formulation of the given task, and the activity of focusing on the user-identification phase were taken into consideration.

The environment that was used as a variable in the first study is now used as a constant, and considering its physical and social features, the nature of the happenings that take place inside it are investigated. The product being inevitably very important as it is the resultant of the total process is assessed. All of the four components are considered since creativity is not a personality trait separate from everything else, but a total assessment of the individual by the social system in terms of “patterns of traits that are characteristic of creative persons” (Guilford, 1968:78). These patterns exist in creative activities like, “inventing, designing, contriving, composing, and planning” (Guilford, 1968: 78). The norms, standards, and values, that these activities are assessed according to, are significant for the social validation of traits, processes, or products, that relate directly to the individual (Beattie, 2000).

The cognitive approach adopted in this study also makes it possible to break creativity down into its components such as the processes, guiding strategies, and structures. Understanding the processes within these components, in return, leads to the activity necessary to support them, and the totality of creativity. Moreover, the possibility of operationalizing and assessing cognitive elements, as Mumford et al. (1997) had claimed, provides a closer perspective to the issue, enabling a more comprehensive link with creativity. They have looked into the processes of problem construction, information encoding, category selection, category reorganization, and category combination that are echoed in the stages of the process of creative problem solving as well. Thus, in terms of operationalization, practicality, and a deeper understanding of creativity, looking at the topic from the cognition point of view that points to the production of novelty as the crucial aspect, is rewarding (Finke et al., 1992; Cropley, 1999).

1.4 Structure of the Thesis

Further chapters of the thesis are organized as follows:

In Chapter 2, in which the background for the study is formed, first the related studies done on the topics of creativity and cognition, and the areas that form the building blocks of this study are dwelled upon. Then various models for the creative problem-solving process are analyzed. The focus is mainly on one of them called, 'The Five Stages of the Model for Sensational Thinking' (5 R's), and is important for the establishment of the theoretical framework and instruments used in this study. This is

followed by the explanation of the means of establishing ideas during creative problem-solving in design, namely, mental imagery and external representation. The chapter ends with the description of the significance of awareness, user identification, creativity as an approach and the concept of time throughout the process of creative problem-solving, as they are also effective on the creative process.

In the third chapter, topics related to the theoretical framework of the study are dwelled upon. The research questions, assumptions, sample group, task, proposed model, and methods of evaluation are discussed in detail. Moreover, the methods of evaluation that are, observation, product assessment, and protocol analysis are examined thoroughly. The study makes use of a combination of the qualitative and quantitative research methods, thus how this combination takes place is explained. The chapter ends with the account of the testing of the methods with a pilot study.

In the fourth chapter which is on the empirical research, the participants, design brief, selection of the task date, setting of the study, analyses of the person, process, and product with the various evaluation methods are described. In this chapter, detailed information on the statistical results in addition to the interpretation and discussion of these findings are given.

In the final conclusion chapter, a summary of the findings and the finalized version of the model are given. Contributions of the study to literature are given, and suggestions are made for further research. This part is followed by a list of the references and the appendices. The appendices include information on the behavior of the students, description and schedule of the “theme train” project used in the empirical research, and the evaluation instruments that were used in the study.

2. BACKGROUND

Both creativity and cognition are terms that are difficult to work with, essentially because they are not easy to define, and as there is no consensus on their innumerable definitions. Creative thinking is an important part of cognitive processing and therefore is inherent in everyone who thinks (Guilford, 1968; Ebert II, 1994).

It has been accepted to be an information-processing method by Ebert II (1994) as a spiral that changes direction at different stages, rather than the common cyclic methods. Although a cyclic model (discussed in section 2.3.1), is used as a basis for this study, this particular model is not quite different from the others. It is composed of five stages: 'Perceptual Thought', 'Creative Thought', 'Inventive Thought', 'Metacognitive Thought', and 'Performance Thought' (see Figure 2.1) as stated by Ebert II (1994). However, it has to be emphasized that creative thought takes place all throughout the cognitive process and not just at a specific stage.



Figure 2.1. The Cognitive Spiral (Ebert II, 1994: 283)

2.1 Basic Terms and Definitions

In order to provide a more comprehensive approach and a better link between the concepts of creativity and cognition, this chapter dwells on the individual definitions of each.

2.1.1 Creativity

Defining creativity is a difficult matter. Often, it is defined with such generalization that carrying out studies is rendered meaningless. Constraints have to be applied to the definition in order to be able to operationalize it. However, applying too many constraints carries the danger of oversimplifying the different variables involved (Candy and Edmonds, 1999).

Over the years, there have been several different definitions of creativity. Among others, Getzels (1975) stated that creativity [a function of knowledge, imagination, and judgment (Basadur et al., 1990)] was subjective and that there could be no universal agreement on it. However -under the influence of globalism, effective communication, and extensive research- the more widely accepted view of today is that, there can actually be a consensus on the issue of what is considered “creative”. That is, in the recent models it is agreed that the majority of qualities involved in creativity, involve more than cognitive processing. Several issues such as, talent, knowledge base, representations of previous work that act as precedents, curiosity, and motivation among others have been stated to influence creativity (Guilford, 1968; Feldhusen, 1993; Purcell and Gero, 1998).

Albert (1990) stated that there were six guiding elements that helped to understand creativity:

1. Creativity is not expressed by products, but decisions,
2. Knowing oneself and one’s world guides creative behavior,
3. Creative behavior is an activity that is deliberately carried out,

4. Creativity and personal identity are emergent,
5. The third and fourth elements are mutually dependent,
6. Creative behavior involves individual identities, motivations, and skills of persons.

Albert (1990) added that, for each individual there was an optimum fit with the environment. Although individual aspects are of utmost importance, there are issues that can be generalized among discussions on creativity. For instance, according to Mooney (1963), four approaches can be mentioned in order to identify creative talent –the creative person, the creative process, the creative product, and the creative environment. Considering these four approaches as separate issues, he came up with the idea of trying to identify what is referred to as creative talent. Following the same line of thought, but considering these four approaches as separate, but related components that come together to form a complete understanding of creativity, Rhodes (as cited in Firestien, 1993) stated that creativity could only become recognizable if there existed an interrelation of the '4P's'.

Isaksen et al. (1993a, 1993b), Jones (1993), among others, have proposed and worked with slightly different versions of this model (see Figures 2.2 and 2.3). Murdock and Puccio (1993) stated that *two* out of four of these components should interact significantly. This explains why the interactions between the creative person and creative process are the components that were mostly looked at in the literature. According to Beattie (2000), in the assessment of creative persons, considering cognitive characteristics during the creative process have received “the highest percentages of like

responses” (p. 178). He, therefore supported the idea that the person and process necessitate a closer investigation.

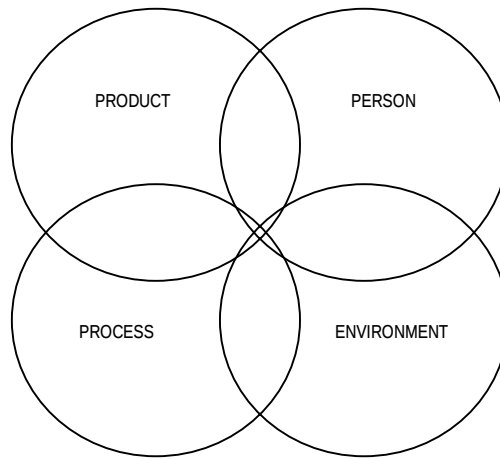


Figure 2.2. Isaksen’s Depiction of the “Relation Between the Elements Defining Creativity” (Modified by the author from Firestien, 1993: 271).

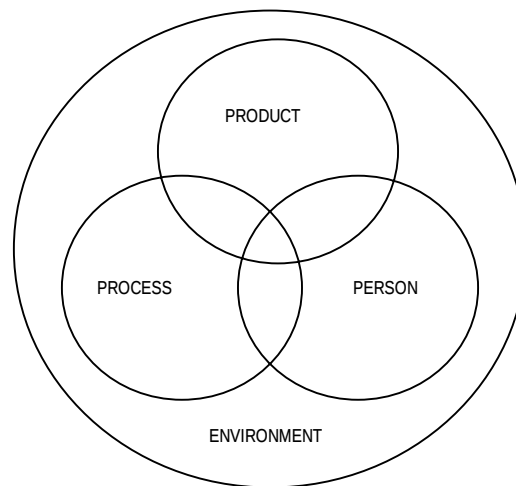


Figure 2.3. Jones’s Depiction of the “Relation Between the Elements Defining Creativity” (Modified by the author from Jones, 1993: 135).

According to Robinson (2003), due to the increased amounts of research being done in the field, the idea of creativity as a quality that only the blessed

few possessed, was left aside. Today, the widely accepted view is of 'creativity as a process of the mind' (Robinson, 2003). Moreover, terms like, 'the designer as magician' or the designing process being commonly referred to as a 'black box' (see Figure 2.4) is being replaced by the will to understand the complex process of design (Jones, 1992; Finke, 1996).

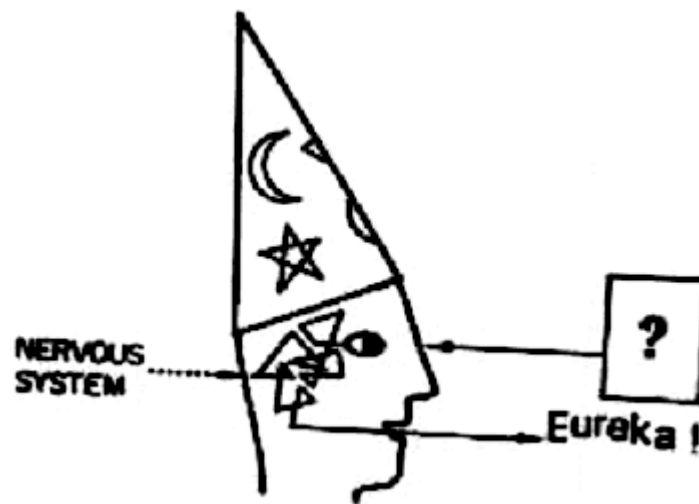


Figure 2.4. Designer-as-Magician (Jones, 1992: 46)

Consistent with this idea, Akin (1984) stated that, "creative processes can be accounted for through purely rational processes" (p. 197). Finke (1996) concurred that, creativity is something that is not unplanned nor unstructured. However, he also added, it is neither fully controlled or structured. That is, deliberate processes are significant, but intuitive qualities are also influential (Finke, 1996).

Apart from studies that have led to these widely acknowledged notions, applications of techniques of operations research and systems theory design,

research that enabled an understanding of how the brain functions have encouraged studies on creativity as well. Other topics include, the investigation of the interaction between different parts of the brain, and electrical processes in the brain at the molecular level (Akin, 1984; Robinson, 2003).

Some other researches concentrated on the differences of the 'perceptual functioning' among individuals. We all perceive the world differently due to our particular backgrounds, in addition to our psychological and physical abilities. If one of our senses were twice as sensitive as it is today, for instance, we would have a completely different perception of the world around us. This would result in a change in the kind and amount of information that we take in, which would affect our processing of that information. Thus, we can say that, the perspective from which we look upon the world shapes our creativity. This perspective can be produced intentionally by adopting a creative 'perspective' or 'approach'. Using this approach, we learn to look upon the world with fresh eyes and re-evaluate it through this new frame (Robinson, 2003). In this sense, it is a selective perception that develops sensitivity in the creativity area, and it can be enhanced by way of awareness and a purposeful tactic (Pereira, 1999).

Adopting a perspective as such is important for one reason in particular, and that is the fact that human beings perceive the world not only by seeing it but also by visual thinking. Besides, although the visual sense is the strongest, we can do the same with our remaining senses as well (Robinson, 2003).

Remembering the past and thinking about the future are actions that we carry

out by visualizing them in our minds, and are incredibly important for a designer. The case of Beethoven being able to compose after he became deaf is an example of such ability.

As a result of these abilities, different types of 'products' are created. Thus, creativity requires something to be done in order to surface. If a person never learns to play the piano, s/he may not realize her or his gift for music. That is why providing different opportunities for human beings while growing up is important for developing those creative tendencies that may otherwise remain hidden.

Following these products and evidences of creativity, comes the need to conform values of the society or culture. However, although peer review is very important, it is difficult to judge something that is ahead of its time, as is the case with new and revolutionary ideas. Although this is so, revolutionary ideas do not come along everyday, and this points to the significance of daily and ordinary creativity that people use throughout life (Robinson, 2003).

Another important factor is that creativity is not a particular finished occurrence, but a 'process'. Thus, finding one's domain of creativity is very important. It is not possible for a person to be creative in every single domain; usually creativity is channeled into a single route or field. People, who are in a field that they do not like, have a hard time realizing their potentials. Obviously, liking a field is not enough to be creative. One also has to know enough of the field to make use of it, make judgments throughout the creative process, and evaluate what s/he has done. Self-assessment is also

connected to the idea of *values* and that creativity should be assessed by experts of the field (Feldhusen and Goh, 1995).

The 'field', according to Csikszentmihalyi (1996), involves the task, operation, occupation, work, craft, profession, or job, but deals with its social and cultural aspects as well. That is, it defines the area and relies on the evaluation and judgments of the decision-makers, the knowledgeable, and the wise in that area. The 'domain' is the formal system of a body of knowledge and its codes, regulations, and operations. New domains are undoubtedly established as investigations that combine different domains are made, or there arises a need for a completely original one (Beattie, 2000). The 'individual' is the one who acquires, collects, organizes, and transforms knowledge, and thus is the one capable of establishing and changing domains and fields (Csikszentmihalyi, 1996).

As in Csikszentmihalyi's (1996) view, creativity is seen as a social construct, it relies heavily on the individual constructs of domains and fields that are shaped according to the values of the society. Therefore, creativity in children is excluded due to the belief that they have not yet achieved sufficient expertise in a particular field to be assessed by it or by the peers of it. Without a doubt, contextual assessment and evaluation according to a different set of norms is always necessary while working with creativity of different groups of people, and not only children (Beattie, 2000).

2.1.2 Cognition

Cognition is basically an “awareness or understanding of information” (Guilford, 1968: 123). Creative thinking has been stated to be a complex cognitive activity (Ebert II, 1994; Feldhusen and Goh, 1995), and a fundamental constituent of cognitive processing (Ebert II, 1994). Therefore, in order to be able to make a more focused definition of creativity, cognitive activities that are influential on the creative process, such as decision-making, critical thinking, and metacognition, should also be defined and studied. Moreover, a complete understanding of creativity can only be achieved through the assessment of cognitive processes and the different stages involved (Feldhusen and Goh, 1995).

Therefore, it can be stated that, issues of creativity and decision-making are the subject matter of cognition. Cognitive abilities involve “discovery, recognition, and comprehension of information in various forms” (Guilford, 1968: 108).

Cognition involves the intellectual activities that enable us to learn and understand the world around us. Quite often, the term ‘cognition’ can be accepted as an equivalent to the term ‘thinking’, ‘the mental process or faculty of knowing’ which involves the issue of cognitive learning (American Heritage Dictionary, 2001). ‘Cognitive learning’ necessitates the focus and method of the learning activity to be the storing, forming associations, and processing of information received by way of the senses. Moreover, it requires an experience to have taken place, and memory to play an important role. The way in which information is received and organized is significant for cognitive learning (Guilford, 1968; Morgan, 1977; Akin, 1984; O’Neill and Shallcross, 1994; von der Weth, 1999).

In this type of learning, changes in information processing, meaning given to things in the environment, visual and sensational information received, and thus, behavior takes place. Mere exposition to the information can be sufficient for this type of learning, without a need for its repetition. Besides, cognitive learning that takes place within cognitive development, can be seen in other highly developed animals, but is especially significant for human beings as a major way of learning (Morgan, 1977; Cropley, 1999).

Cropley (1999) mentioned the research from different sources that define the stages of cognitive development that have helped him in forming his own perspective regarding the creativity-cognitive development interaction.

According to him, Piaget's view is one of the most famous of these standpoints where he has identified four stages: The Sensorimotor Stage, Preoperational Stage, Concrete Operational Stage, and the Formal Operational Stage. Case has added a fifth stage that has to do with the recognition of second order relations, whereas Commons, Richards, and Kuhn (as cited in Cropley, 1999) have suggested the Stage of Systematic Operations for the same stage, and a sixth stage of Metasystematic Operations that deals with operations on systems. According to Cropley (1999), Taylor's view, is also helpful in clarifying the cognitive development-creativity relationship. The first level, in his sequence, is "expressive spontaneity", in which there is limitless productivity. Then comes "technical creativity" that involves the 'bringing together' of knowledge, skills, and methodologies, and is followed by "inventive creativity" in which a person 'redefines' something in a new way. "Innovative creativity" and "emergent creativity" stem from inventive creativity, as stages that extend the existing

systems and develop new ones, respectively. During these stages, one forms relations between different parts of the task, in order to make sense of it as a whole (Cropley, 1999: 256-257).

In cognition, associations between objects in the environment and experiences are very important. The associations that are made in the mind may or may not surface. Due to the desire to understand these relations, cognitive maps and place learning have been at the focus of research on cognition (Morgan, 1977; Ebert II, 1994). The stages of creative problem-solving have to be considered alongside cognitive development in order to achieve a complete picture of the process of creative activity.

2.2 Cognitive Stages of Creative Problem-Solving

Creative thinking and problem-solving are often interchangeably used, as they are fundamentally the same cognitive activity. Individuals involved in creative production have often reported to adopt a scheme, motif, or plan early in the process. This system or skeleton takes on more and more details throughout the process as it proceeds. It is constantly evaluated, transformed, and revised at different levels of elaboration (Guilford, 1968; Eisentraut and Gunther, 1997; Lemons, 2005; Plsek, 1997; Kristensen, 2004).

Design, that inherently involves a creative problem-solving activity, necessitates the making of decisions in order to fulfill certain objectives. Generally, someone in the process of designing has to be flexible and adapt

their problem-solving technique to the requirements of the situation (Eisentraut, 1999). The way in which this cognitive activity is carried out in design is actually similar to the individual's usual approach to other problems in life. A unique, designed product is the result of this whole process of creative problem-solving (Akin, 1984; Kokotovich and Purcell, 2000; Lubart, 2001).

2.2.1 Models for the Creative Problem Solving Process

Over the years, several different models have been proposed to explain the process of creative problem-solving. In fact, these models are not extremely different from each other, and have quite a lot in common. The first of these models was originated by Wallas in 1926, and consists of four stages (Plsek, 1997: 2):

- 1. Preparation:** definition of the issue, observation, and study
- 2. Incubation:** laying the issue aside for a while
- 3. Insight or illumination:** the moment when a new idea finally emerges
- 4. Evaluation, revision, or verification:** checking it out

In the first stage, the person tries to understand the problem and collects necessary information that seems relevant. This is the preparation stage. Then s/he tries to solve the problem, but may not be able to even by spending a certain amount of time on it. As a result, s/he may suspend the process for a while, thinking that s/he will be more successful in the future, and this is called the incubation stage that corresponds to the reception and

reflection stages used in this study. It is a stage that necessitates internal evaluation and commonly a private space that enables this personal activity (Kristensen, 2004).

At this internal level, some obstacles that may have before prevented the solution of the problem, start disappearing. The person, already having the problem in mind, keeps on learning new things that may aid in the solution. S/he continues to collect information both consciously and unconsciously at this time, while preparing for the following stage. In the illumination phase, grasping of the whole process can be observed, and the network suddenly adopts a pattern that works with the inputs and looks like it will solve the problem after having tried and failed so many times before. The thinker then has the feeling of 'a-ha!', and at this point, a solution that is novel, at least to the thinker, is produced by way of the thought process. In the evaluation, the thinker assesses her or his idea, and if s/he decides that it does not work, the whole process is repeated. Additionally, sometimes the idea is correct or works in principle, but needs adjustment in certain parts (Morgan, 1977; Jones, 1992; Verstijnen et al., 1998; Kristensen, 2004).

Plsek (1997) claimed that, Barron's Psychic Creation Model, Rossman's Creativity Model, Osborn's Seven Step Model for Creative Thinking, the Creative Problem Solving Model, Koeborg and Bagnall's Universal Traveler Model, Bandrowski's Model for Creative Strategic Planning, Robert Fritz's Process for Creation, all make use of a similar framework to establish the stages of the creative process. Jones' (1992) model explaining the same process for the field of design follows the same logic. Moreover, certain

common themes preside all of these models. Some of these, according to Plsek (1997), are as follows:

- The creative process involves purposeful analysis, imaginative idea generation, and critical evaluation. The total creative process is a balance of imagination and analysis.
- Older models tend to imply that creative ideas result from subconscious processes, largely outside the control of the thinker. Modern models tend to imply purposeful generation of ideas under the direct control of the thinker.
- The total creative process requires a drive to action and the implementation of ideas. We must do more than simply imagine new things; we must work to make them concrete realities (p. 6).

Plsek (1997) has stated that 'The Directed Creativity Cycle', that is an integrative model that combines the previously proposed creativity models, is a useful one that stresses the importance of implementation in the real world, and thus can be used for the operationalization of the concept (see Figure 2.5). The cycle involves four different 'types' of stages -consisting of four separate stages each- that intermingle.

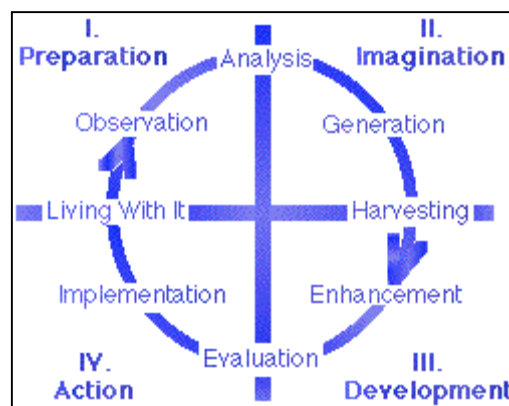


Figure 2.5. The Directed Creativity Cycle (Plsek, 1997: 3).

According to this view, 'everyday living' is a creative activity. Careful 'observation' of the world is followed by thoughtful 'analysis' of how things work and fail. The reserve that we end up having as a result of these activities help us 'generate' original ideas by way of 'combining' and 'associating' different concepts. This is done in different ways such as, analogies. In order to be able to make good decisions, we 'harvest' and 'enhance' our ideas before we reach a final 'evaluation' of the topic followed by the 'implementation' of them. The real life experiencing of the idea that is put into trial follows the implementation, and the cycle begins over again. Preparation, imagination, development, and action are the four phases of the model and aid in allowing the connection between this and other models (Plsek, 1997).

Comprehension of the various models for the creative problem-solving process is significant in depicting the differences and similarities between them. More importantly, the progress of the models can be seen as they become more and more elaborate.

2.2.2 Five Stages of the Model for Sensational Thinking (5 R's)

Understanding the stages in a model for the creative problem-solving process helps the formation of the assessment methods and supplies the essential building blocks of this study. This in turn, enables the establishment of a comprehensive approach to the whole process of creative problem-solving. This holistic understanding is what this study aims to reach.

O'Neill and Shallcross (1994) classified the creative problem-solving process into five stages in the Sensational Thinking Model (see Figure 2.6). It is called the model for Sensational Thinking because they believe that, depending on the functioning of the sensation/ perceptual processes, the creative process of establishing the relationship between uncertainty among parts and boundaries that characterize systems can be defined.

Having mentioned the cognitive stages of creative problem-solving, it is important to state that, the Five Stages of the Sensational Thinking Model of O'Neill and Shallcross (1994) separates itself from other models as it enables trouble-free operationalization of the concepts. The reason for this is that, the model sees perception as a naturally occurring dynamic system that makes up a creative process. This is especially important because it helps link cognition and creativity by enabling the relation between the Five R's Model of sensational thinking, and the Four P's model of creativity that constitute the stages within the creative process of decision-making. Within these stages, establishing ideas and the nature of how this is done is significant.

The five stages of the model are as follows (O'Neill and Shallcross, 1994):

- 1. Readiness:** relaxation activity that necessitates letting go and being open to the possibilities (p. 82).
- 2. Reception:** observation with all the senses, to experience fully and observe with all the senses (p. 82).
- 3. Reflection:** remembering activity and allowing time for internal interaction (p. 82).

4. **Revelation:** focusing and pattern recognition (p. 82).
5. **Recreation:** to determine full message content and express it by various methods, such as drawing (p. 83).

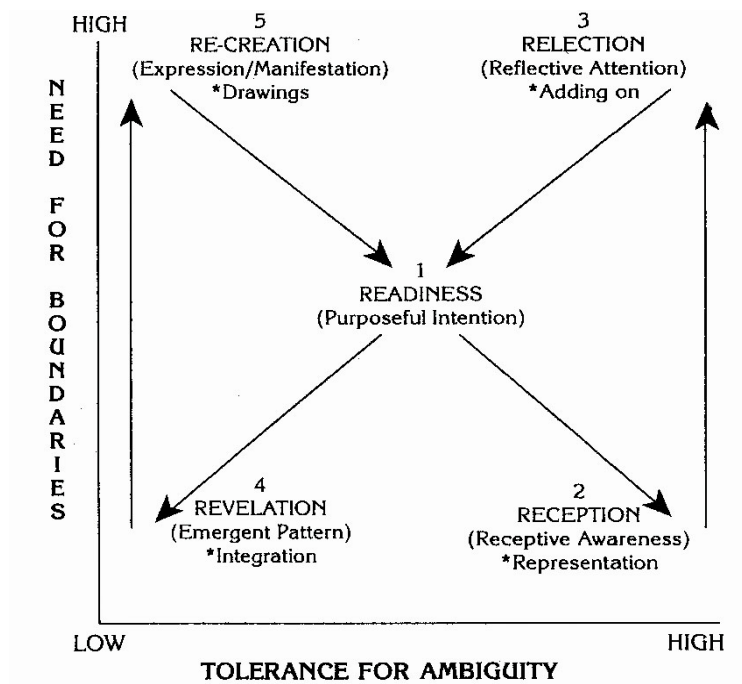


Figure 2.6 The Five Stages of the Model for Sensational Thinking
(O'Neill and Shallcross, 1994: 79).

Although this model is very similar to Wallas', proposed in 1926 for the process of creativity, it includes the final stage –the stage at which at the collection of ideas are expressed, that is, when a product is produced (Plsek, 1997). This feature makes it more comprehensive. A more detailed look at the stages is necessary at this point to clarify why this model is more suitable to the study than the others.

Stage 1: Readiness

Readiness is the phase at which the relaxation activity that necessitates letting go and being open to the possibilities takes place. It is the stage at which the person gets ready -in various ways- to begin problem-solving process. It is also when the issue, observation, and study are defined, and preparation, analysis, and initial idea conception takes place. It is generally believed to involve more imagery than representation (Jones, 1992; O'Neill and Shallcross, 1994; Ulusoy, 1999; Kristensen, 2004).

The beginning phases are especially important since they are the stages at which the restructuring of the task at hand takes place. Formulating new problems and asking new questions often enable creative results (Darke, 1979; Akin and Akin, 1998; Kristensen, 2004). A study done by Edmonds (2000) showed that, the time spent during the initial phase in which the person analyzes the task and tries to come up with his or her own question, correlated very highly with the originality of the results. Thus, it may be stated that, finding the problem might be as important as solving it. Akin and Akin (1998) also supported the idea that, the more time individuals spend for planning at the early phases of a task, the more creative results they come up with. Moreover, they saw that the more experience one gained in the subject of writing, the more time s/he spent planning at the initial phases. When a person is functionally and mentally ready for the task, s/he begins to look around for ideas and observes the task intently. This is when s/he passes onto the next stage.

Stage 2: Reception

Design involves the creative activity of structuring both the problem and the solution spaces of what can be named the “analog of a puzzle” using different sources of information (Akin and Akin, 1998: 127). This stage of the design process is one at which observation with all the senses, fully experiencing the task, and using idea conception sources take place. Moreover, imagination, generation, idea selection and/ or refinement are evident. Shifting and redefinition of the problem space –which is a critical aspect of creativity- also take place (Akin and Akin, 1998).

Moreover, at this phase, the importance of the remembered knowledge is apparent. Here, the first trials of integrating previous domain knowledge into the features of the new problem, and combining it with new information are begun. Both know-how and know-that are essential at this stage (Akin and Akin, 1998; von der Weth, 1999; Kristensen, 2004;). However, it is important to mention an interesting fact about the relationship between creativity and knowledge. The remarkable drawback about knowledge is that, knowledge and creativity have a bell-curve relationship (see Figure 2.7), that is, having too little or too much of knowledge hinders creativity (Abel, 1981; Daniels-McGhee and Davis, 1994).

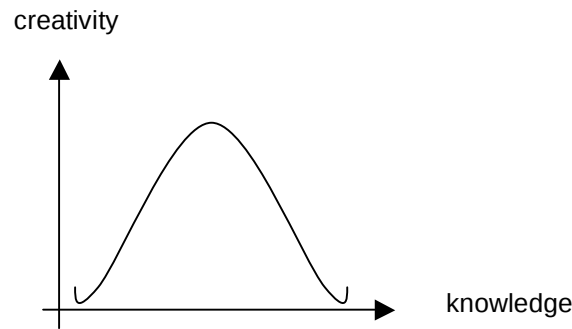


Figure 2.7. The 'Bell-Curve' Relationship Between Creativity and Knowledge (Abel, 1981: 211).

Knowledge is made up of both tacit (implicit) and explicit knowledge. Abel (1981) stressed the significance of tacit knowledge gained in the studio environment. In addition to the explicit information given to the students in their courses, they are also surrounded by other sources of information that are not and perhaps cannot be named. The whole is truly more than the sum of its parts. It is difficult to gain access to these sources, and understand which are the most effective features regarding the environment, but since it is an important channel of information, it should be looked at. Thus, having an understanding of the creative process can tell us more than we expect. When the person passes from observing the task to externalizing the initial ideas, it can be stated that the reflection stage has begun.

Stage 3: Reflection

At this stage, remembering activity and allowing time for internal interaction are noticeable. The person lays the issue aside for a while, restructures and evaluates the steps taken and the whole process, shelves or abandons work. It is a stage at which harvesting, evaluation, idea development, enriching and

expanding discovery take place that prepare the person for the next step. He or she may alternate between rigorous sessions of imagery and representation at this stage, and when one of the options is chosen among alternatives, it can be stated that the next stage has begun (Jones, 1992; O'Neill and Shallcross, 1994; Akin and Akin, 1998; Ulusoy, 1999; von der Weth, 1999; Kristensen, 2004).

Stage 4: Revelation

This phase necessitates the person to focus and recognize patterns, and prepare for the moment when a new idea finally emerges. S/he develops and enhances the idea and/or the product before the final stage is begun. When the rudimentary and basic version of the finalized representation of the task begins, one has entered the final stage (Jones, 1992; O'Neill and Shallcross, 1994; Akin and Akin, 1998; Kristensen, 2004).

Stage 5: Recreation

This is the final stage of the process, and it involves the determination of the full message content and expression by various methods, such as drawings or sketches. All useless ideas are abandoned and details are finalized at this stage. The person checks and controls the final representation for missing parts, finishes it off, and resolves it. Following this stage, the final product is either opened to exhibition and assessment by others, or destroyed. As a result, the person begins living with the product or the idea of having finished it (Jones, 1992; O'Neill and Shallcross, 1994; Akin and Akin, 1998; Ulusoy, 1999; Kristensen, 2004).

Knowledge of the five stages of the model for sensational thinking plays a significant role in the development of the instruments used in this study. Therefore, what takes place during these stages is imperative for this study. The means of establishing ideas during the process are especially valuable to comprehend the stages at length.

2.3 Means of Establishing Ideas During Creative Problem-Solving in Design

In the cognition literature, 'mental imagery' and 'external representation' are implicit parts of the creative process (Daniels-McGhee and Davis, 1994). Both are often regarded as two equivalent means of establishing ideas during creative problem solving in design. However, these two processes are differently related to one another ontologically. Just as every creative process does not lead to a creative product, every mental imagery process does not lead to an act of external representation. However, external representation presupposes a mental imagery process, just as the formation of the creative product assumes a creative process.

2.3.1 Mental Imagery

Creativity and imagery are very tightly connected to each other. Creativity undeniably involves 'imagination' that is forming the mental image of something that does not exist. Imagery involves the formation of an individual subset of unique ideas that are both involuntary and controlled sources of novel interpretations derived from a larger domain (Simonton, 2003).

There is a continuous process of selection, revision and improvement of a potentially creative idea or product (Daniels-McGhee and Davis, 1994).

Thoughts formed in the mind related to the task at hand are almost always vague, intangible, elusive, and blurred (Eastman et al., 2001). The moment an idea starts taking shape, even just a bit, the designer quickly externalizes it in a certain way. Thus, the idea becomes a part of the development process. It is not common for an idea to begin and complete its development in the mind only to come out at a finished state (Purcell and Gero, 1998; Simonton, 2003).

The primitive thought that is externalized begins a continuous cycle of repetitions of imagery and representation until at one point the designer decides to draw the final drawings. Very often, even at that stage, quick decisions are taken. The reason for this lies primarily in the individual dispositions of the imagery process and the primitive externalization techniques. As mentioned above, the vague idea formed in the mind may not be easily applicable to real life situations (Eastman et al., 2001). On the other hand, in terms of externalization, a sketch for instance, is often out of scale, lacks proportion, and open to reinterpretation. Thus, it cannot be readily adapted to a realistic task that requires all the necessary issues of design like proportion, harmony, order, and scale with the correct dimensions. However, the sketch is often associated closely with both creativity and imagery (Akin, 1984; Purcell and Gero, 1998; Verstijnen et al., 1998). Sketches quicken the process, improve results greatly, and aid the restructuring of the problem that has been given. This process is especially helpful for designers who have

learned to use the sketch as a tool, and necessitates discovering new information by combining the new input and previous knowledge (Verstijnen et al., 1998).

Three levels of imagery can be defined as, superficial, covert, and interactive. In superficial imagery, a vague picture is formed in the mind, while in the covert imagery, clear and detailed images are formed. These images may involve emotional aspects with relation to reality, whereas, in interactive imagery, there are often strong emotional aspects in addition to interaction with the image in mind (Ahsen, 1984; Bagley and Hess, 1984; Purcell and Gero, 1998; Eastman et al., 2001; Lemons, 2005). Seeing oneself actually interacting with the reality created in the mind is a significant skill of designers (Yokochi and Okada, 2005).

The creative process of designing is explained in various ways by different researchers. For instance, Goldschmidt (1992a) has referred to the process of 'visual thinking', which is somewhat different than the systematic approach taken in this study (imagery followed by externalization followed by imagery and so on) as according to this view, the process is a whole. That is, she states that the sketching phase cannot be separated from the thinking phase as designers 'think' by sketching. She sees this as one stage and the finalization of the design as a second stage. However, there are so many stages involved in a design process that looking more deeply at the sub-stages may help interesting issues to surface. This approach has truth in it, but can one really state that sketching can take place simultaneously with the thought that actually -inescapably- precedes it?

The answer lies in how Goldschmidt (1992a) has set up her framework. If the process begins with a given problem leading to a thought leading to an external representation, her research picks up the line of events from the point after the first idea has formed. After that first idea, perhaps the thought and the representation come closer to one another, and may seem to happen interactive visualization process. Goldschmidt (1992a) explains this as such:

Interactive imagery implies that mental imagery and the production of new images are interdependent: one gives birth to the other. Figure on paper triggers an image, which in turn provokes a new figure in this two-way associative road (p. 602).

This is true, but it is a process that begins and takes hold after that first thought or thoughts are formed. For the solution to jump from the given problem to the sketch oversees certain stages, and thus it is important to start analyzing from the very beginning of the process -the first idea- where the most important and far-reaching decisions are taken (von der Weth, 1999).

The stage of establishing the first idea is followed by a series of external representations that take place in an alternating way with the mental images. One idea leads to a representation of it, that leads to a developed version of the previous idea, that leads to a developed externalization, and so on. That is, the ideas develop successively and gradually, with one idea helping the progression of both the external representation of the previous idea and the thought that follows it (Goldschmidt, 1992b; Eisentraut and Gunther, 1997).

2.3.2 External Representation

Sketches as significant contributors of the creative process, are used at different phases of design and have different roles. In the early phases of design, 'idea-sketches' that interact with imagery and used individually are utilized. They come in the form of scribbles on napkins or behind envelopes, and have large effects on later stages of the process. These sketches are replaced by 'presentation-sketches' that are aimed at other people. Even though they are helpful for individual use as well, they have to be especially prepared so that others can understand them (Verstijnen et al., 1998).

Sketches are also often used as proof of previous stages of the process and a place to come back to further along the progression. They also serve both as a mental playground where ideas are played around with, and a construction site where ideas are tried out before actual application. Therefore, they play a large part in the creative problem-solving process (Suwa et al., 1998).

Although most sources related to external representation in design dwells only on sketching -which is undoubtedly one of the most important tools a designer has- an outcome that is a result of a mental imagery process need not be in the form of a sketch. This representation can range from the writing of related keywords to a form achieved by folding paper. Thus, sketching is only one of many different ways of externalizing thoughts. McGhee and Shallcross (1994) explained the relationship between imagery and creativity as a process that involves a "pool of novel representations" (p. 169) that are

put aside and the selection of one particular solution that is found worthy as a result of several trials (see Figure 2.8).

Designing by using sketches and scale drawings helps to eliminate 'trial-and-error' that might have been necessary for actual production if other planning methods like models and drawings did not exist. Trial-and-error, experimenting, and change are all done on the drawings, which is much easier and, naturally, less costly.

In design, drawings are used for thinking and not making. Making takes place following a completed thinking phase that makes use of several drawings at different levels of development. The separation of the two phases has many consequences, such as, the splitting up of production (division of labor) which also speeds up the production process, and the provision of being able to plan large and complex things by one person or small groups of people (Jones, 1992).

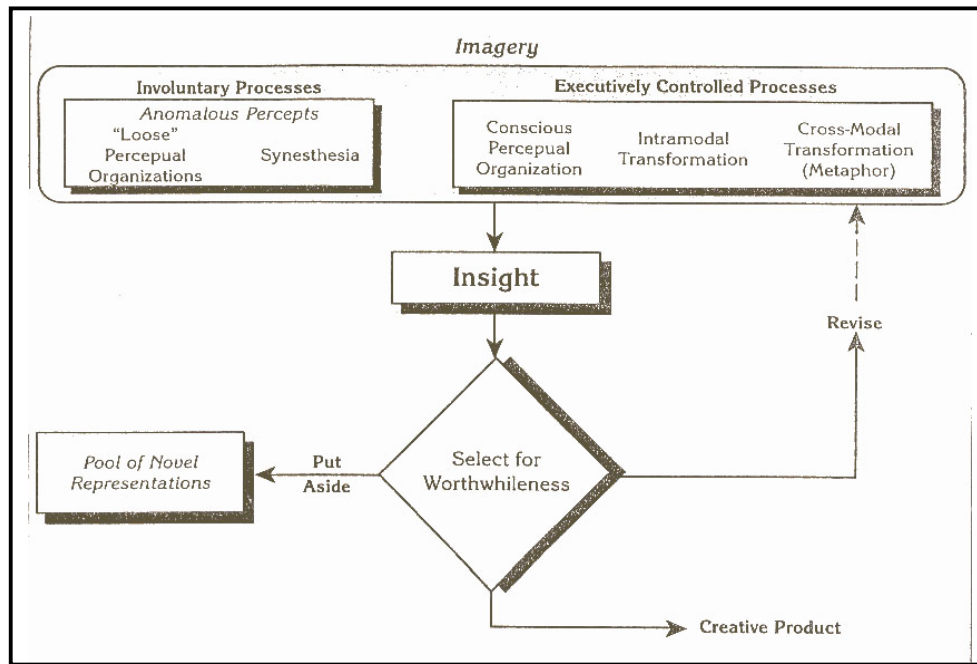


Figure 2.8. A Schematic Representation of Imagery and the Creative Process (Daniels-McGhee and Davis, 1994. 169).

2.4 Concepts Related to Creativity

Awareness of the creative process, identifying with the user, and adopting creativity as an approach, as well as the use of time throughout the process of creative problem-solving are significant issues that have consequences on the design process. Therefore, they need to be considered to support the foundation of the study.

2.4.1 Significance of Awareness, User Identification, and

Creativity as an Approach

This study bases its foundation on three additional crucial and interrelated issues regarding methods of supporting creativity. The first of these is to understand ways of raising students' 'awareness' about their own creative

processes. Awareness is the first step to improvement and support of creativity, and begins with the students' understanding of the exact aim of a given task. It takes place at two different levels: awareness of what is expected in terms of creativity, and the full comprehension of the project. The second issue is about awareness in the long run and composed of four important features which are: expertise, problem-solving skills, adaptability, and wisdom (Cropley, 1999). Too often designers miss the aim of a given task due to concentrating on the peripherally related issues, thus also overlooking the aspects by which the task is to be assessed.

The concept of 'user-identification' is the second issue of utmost importance. In the design field, the branches of design that are as much functional – interior architecture as compared to graphic design, for instance- as they are aesthetic, and deal with a user group and/ or client, the issue of identifying with the user is a very important one. Although this is so, it is not an issue that has been investigated to a great extent. Thus, the question of whether a deliberately employed user-identification activity in different stages of the process will enhance the creativity of the products is examined.

Recognizing, identifying, and supporting of this empathetic activity at different stages of the design process are necessary for two reasons. First, although any creative design process begins with a significant user-defining stage, because it takes place before any preliminary sketches have been done, it does not extend into the following stages of design, and loses importance and effectiveness during the course of the process. Another important aspect is that, the preliminary user-defining stage is almost never a stage in which the designer actually identifies with the user. Quite often, designers -during

their education or while working professionally- are so caught up in employing the aesthetic issues and design principles that, they unintentionally lessen the role of the user in their designs. Especially in the long run, negligence of the user's characteristics and needs may cause innumerable problems.

The final crucial issue is the idea of 'seeing creativity as an approach or perspective' rather than an event or occurrence. If this view is adopted, it is much more likely for people to collect information from their environments and approach problems that way. Thus, a carefully planned approach to the students' creativity is believed to be advantageous.

2.4.2 Concept of Time Throughout the Process of Creative

Problem-Solving

Formulating the problem is often equally important as the creativity of the product. Approaching a task from a different angle, raising a new question, or opening an area of new possibilities is one of the most significant issues – and one that is introduced very early- in the creative process. The concept of 'time' is connected to this issue. How much time the person takes to examine the task, formulates how to begin, and does nothing but to observe the problem at hand, have effects on creativity.

Research findings suggest that, 'originality', an important characteristic of creativity, is correlated highly with the time spent during the problem finding and/ or defining phase. Although spending more time contemplating on the task led to increased creativity, there was not a linear relation with the quality

of artisanship, and therefore what will have little effect on the assessed creativity (Edmonds, 2000).

The observation time, on the other hand, is a key aspect in the study. How long a student analyzes the task at hand, looks at it, reads the task requirements are significant. Studies making use of time spent in the pre-design phase are few and the ones that exist mostly have focused on artwork and experimented with students of art schools. Spatial issues, that is, studies that relate architectural design and timing in creativity-cognition issues are even less although these aspects are very significant in spatial design.

3. THEORETICAL FRAMEWORK OF THE STUDY

In most studies, there is a lack of a comprehensive approach to creativity, due to the concentration on the term itself and an ignorance of other significant processes such as discussion, interaction with others, accessing and transforming information from the environment, and relations with peers. This limits both the understanding of the term, and the generalizability of the results derived from a study.

Thus, this study looks at the relationship between creativity and cognition from a more comprehensive perspective. Within the concept of cognition, it dwells on 'imagery' and 'representation' -two stages within the design process. The object-level and meta-levels are also investigated. Methods of assessing imagery quantity are developed in addition to the analysis of the sub-contexts of imagery and external representation, with a focus on the means by which imagery quantity and representation affect creativity. Although previous studies have looked at the cognitive decision-making process, teaming it up with creativity and quantifying imagery and representation within the total course is a rather new approach.

Another gap in the field is a result of decision-making during the design process being studied without developing models that are not radically different from the models explaining decision-making in any other field. This is an incorrect approach due to the unique dynamics involved in the design process. Trying to explain the design process by replicating it on the

computer is a recent approach which has not been elaborated enough to apply to different situations, although it is similar to the previous one in the way that it accepts a steady and dependable chain of action each time when anyone attempts to design something (Goldschmidt, 1992a; Lubart, 2001). However, this should not mean that there is no way to understand this type of process, as with deep analysis, situations that lead to certain associations and eventually, creative results can be understood, and this vague process with sporadic outputs taking place during its course, can still be explained (Weinstein, 1996; Purcell and Gero, 1998; Eastman et al., 2001).

Understanding the total process in detail, recognizing creative thoughts and what precedes and leads to them, how they are transformed into more complete ideas, and how they are finalized are important so that this progression of stages can be improved. The term 'improvement', here, is used as a comprehensive way of expressing enhancement of creativity and efficiency in the design process. This study redefines that as, solving the problem in a limited amount of time in an appropriate and useful way that is very creative and efficient.

Guilford (1968) had stated that creative productivity, which is a very rare occurrence, has very little correlation with education. This appears to be true in the present day as well. He also stressed the importance of the development of the creative process –that is, learning to think constructively- in order to increase creative productivity. He added that especially in the arts, visualization could make significant contributions to creative productivity although he did not state just how or how much.

The findings of this study intend to serve the difficult task of understanding the relationship between visualization/ imagery quantity and creativity. How much of the creative process goes inside one's mind, and how much of it is represented outside, in what order, and by which methods -color, sketches, writing, etc.- are investigated. If these are understood, the creative process within a given design task can be arranged according to the requirements of the curriculum and the creative needs students. That is, the curriculum can be shaped aiming to enhance the representational skills of the students that have to be strengthened. This in turn, may affect both the speed at which the creative process takes place, enabling better representation of the ideas in the mind and aid in the teacher's critiques as well, as they might give better critiques due to understanding the students' thoughts better. This topic relates to visual and verbal communication (Lemons, 2005; Ulusoy, 1999). Since design is possible only by efficient communication at school as well as in professional life, communicative representational techniques should be well developed in every designer. Thus, having effective communication in the studio can be considered as practice for real-life situations.

Among other important issues regarding real-life situations, 'timing' is one of the factors that is looked at in the analysis of micro-strategies. The relationship between the amount of time a person analyzes a given task and the amount of creativity of that particular person is examined. How much of the design solution is begun in the mind, when and in what format the

externalization (external representation) of the design is done, are also the issues that are investigated by protocol analysis.

Moreover, the dynamic and evolutionary characters of creative design activities are analyzed according to method, activity, and product. This enables the investigation of the 'abstraction → reification → reality' process by looking into the concepts (ideas) embodiment (analysis/ synthesis) aspects.

Dorst and Cross (2001) have defined creative design as follows:

Creative design seems more to be a matter of developing and refining together both the formulation of a problem and ideas for a solution, with constant iteration of analysis, synthesis, and evaluation processes between the two notational design spaces; problem space and solution space (p. 427).

To these two spaces, three-dimensional space could be added, as the students' use of the studio environment during the creative process is a reflection of creative characteristics. Therefore, these simultaneously evolving spaces have effects upon the use of the movements in the studio space, and this idea is in keeping with the "co-evolving" nature of the previous spaces explained by Dorst and Cross (2001: 427).

The aim of the study is to understand the process of creative decision-making during a design task, and to investigate ways to improve the creative characteristics and quality of decisions that are made in the design studio as a preparation for professional life. Compared to the studio, practice involves more variables that have limiting effects on the process of creative decision-

making. Although this is so, the field of interior architecture (a field that combines different groups of people, jobs, methods, and equipment), gives way to several opportunities for ideas to emerge. Additionally, the design studio gives the opportunity of experimenting with them using various creative ideas that are either reproductions of previous memories or combinations of them, considering the requirements of the curriculum.

3.1 Research Questions

The initially proposed research questions to be answered in this study are as follows:

- 1- What is the relationship between cognitive development and creative problem solving?
- 2- What is the relationship between the amount of time the task is observed and creativity?
- 3- What is the relationship between imagery quantity and creativity?
- 4- What are the characteristics of the decisions made throughout a creative problem-solving task?
- 5- What is the relationship between the observed creative traits and the decisions made?
- 6- Can the creative quality/ characteristic of the decisions made be increased?
- 7- How is the design studio used and what are the creative behavioral traits displayed during the solving of a creative design task?

It is obvious in a field that has a direct link, and thus a dependence on practice, creative decisions are made visible only by an action, a product of a process. The processes behind decisions are complex and difficult to observe and identify. Every decision is a product of a stage of the process, all leading to the final product that aims to satisfy the goal of the task. The general purpose of the study is first to understand, then to improve the creative quality of decisions made during designing before and after graduation.

Moreover, understanding the cognitive aspects involved in different levels and stages during a creative task, the decision-making process, the relationship between the amount of time the task is observed and creativity, the relationship between imagery quantity and creativity, students' thoughts on where and in what kind of environments they would feel the most creative in and produce creative ideas that are of flexible and fluent quality, students' behavior within the studio environment (interactions among themselves and with the instructor, use of space) during a creative activity will give insight into the creative process on various levels. This will help open up the possibility of bringing out the creativity inside the students, organizing the atmosphere that they work in a way to enhance creative potential, bring about suggestions for curriculum changes, and improve designs of the students both in the studio and after graduation.

3.2 Assumptions

- There is a relationship between the type and quantity of representation, and creativity.
- The creative quality/ characteristic of the decisions made can be increased by way of first understanding the creative process that involves cognitive components.
- There is a relationship between the observed creative traits and product creativity.
- There is a relationship between imagery and representation amounts and creativity.
- A deliberately applied user-identification stage may improve the quality of design products.

3.3 Sample Group

As the sample group, the third year design studio in the Interior Architecture and Environmental Design Department, Bilkent University in Ankara was chosen. The main reason for this choice lies in the bell-curve relationship between creativity and knowledge mentioned in section 2.2.2.

Dacey (1989) had mentioned that, creative cognition and production take place in cycles and at certain periods in life. The third year of university education can be considered as the completion of a learning cycle for the interior architecture students. When the students reach that stage, they have learned the discourse of design, formed a certain approach or style, and can clearly state them while or after dealing with a task. This would especially be compatible with the method of protocol analysis used while the students make creative decisions regarding the design problem given to them.

Csikszentmihalyi's (1994) tripartite understanding of creativity, composed of the 'field', 'domain', and 'individual' is also helpful in understanding why this particular year was chosen. He asserts that a certain amount of expertise is to be possessed by the individual in order to be creative in a domain and be assessed according to the necessities of the field.

In several studies, as in Kokotovich and Purcell's research (2000), the creative processes and products of designers and non-designers are compared to assess their creativity. In this study, however, the view that it is unfair to compare designers and non-designers in a design experiment is supported, as it is almost obvious what the results will be. Since the skill in many aspects related to design can be significantly different even in design students who are in different grades (Chiu, 2003), comparing designers who are much more familiar with vague design tasks and representations of them with non-designer students, can be misleading in terms of the generalization of results. That is, the differences between both groups' creativity will be due to a number of factors separate from -or in addition to- just the task itself. The same thing applies to students who are in different branches of design like comparing graphics and architecture students. Consequently, the focus is on the creative process and thus the individual creative techniques/methods of a group of students in the same grade are looked at.

3.4 Task

The task plays a significant role in this study, as it necessitates a 'creative problem-solving process' to take place in order to form a 'creative product'.

The 'creative person' is inherently involved in both the process and the creation of the product within an environment. Therefore, the essential elements of creativity can be investigated with the important contribution of the task.

Using behavioral traits and the use of space as a guide, the creativity enhancing 'conditions' that exist during the particular task (for instance, preparing preliminary sketches for a semi-public space) given to be solved are sought. Moreover, the lacking and complimentary conditions that relate to the social as well as the physical environment are investigated.

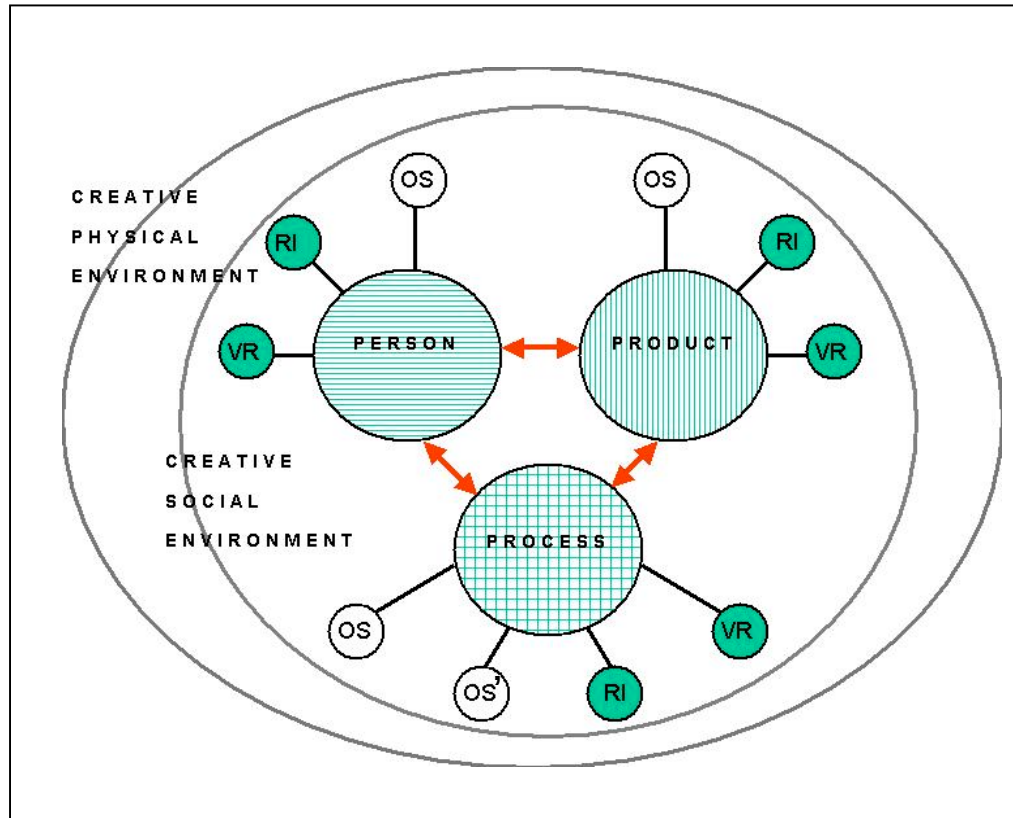
How well a task is defined varies greatly, and this has influences on the relation between the inputs and the outputs. While in some tasks, it may be easy to clearly state the stages of the solution to the problem, in others, it may not be so (Ericsson and Simon, 1993). An automated process prevents information that is available to the person himself or herself, and thus the experimenter. The length and specificity of the design problem in this study is believed to be appropriate for gathering the necessary detailed information to understand the cognitive decision-making process.

For instance, regarding the tip-of-the-tongue phenomenon, visual information and environmental cues seem to be stronger than other sorts of information, that is, people remember pictures quicker and more easily than information obtained by hearing, they remember the place that they have seen a photo of someone quicker than their names or when they had seen it (Ericsson and Simon, 1993; von der Weth, 1999). Issues such as orientation and physical

and conceptual links inside a space are important for people with cognitive delays (Moore et al., 1987), and therefore, the design project is believed to surface information on the cognitive aspects such as these during the process of creative decision-making.

3.5 Proposed Model

Taking into consideration the approaches and models discussed in Chapters 2 and 3, an initial version of the model that will be used in this study is developed (see Figure 3.1). This model includes theoretical and methodological aspects from the previous study that operates as a basis for this one (Hasirci and Demirkan, 2003).



(OS: observation sheets; RI: retrospective interviews; VR: videorecordings)

Figure 3.1. Proposed Theoretical Model

Bearing in mind the 4P's of creativity, it can be stated that the model will look at the creative person, process, and product as the interactive elements within the environment. The environment is necessarily separated as the physical and social environments, and considered as the shell in which the process takes place. The focus is, as previously mentioned, the creative design process. However, the process does not take place in vacuum, necessitating the examination of the remaining three of the 4P's as well.

The model shows that the creative person, product, and process that are closely related to one another. They feed each other, and have shared

elements within the process. OS, OS', RI, and VR indicate the instruments that are used for the assessment. OS in the creative person and product in addition to OS and OS' in the process are equivalent to one another, as they make use of the observation sheets. RI and VR in the creative person and product, and RI and VR in the creative process refer to the retrospective interviews and the video recordings, respectively. The combination of all the instruments is expected to yield a comprehensive understanding of the creative process within the design studio. The model will be reassessed at the end of the study to discuss changes and modifications.

3.6 Methods of Evaluation

The methods used are 'observation', 'product assessment', and 'protocol analysis'. While 'observation' is in use during the students' creative design process, the latter two are done after the completion of the task.

3.6.1 Observation

The observation was done with the aid of assessment sheets (see Appendices A and B) that include the recognizing and assessment of creative characteristics, traits and behavior carried out while dealing with a task, and videorecordings. The context of the observation involves the assessment of the students, recognizing the creative traits and behavior that each student carries out, their use of space, social interaction, and the marking of the any additional movement that may take place in the studio. Videotaping the whole experiment aids in obtaining any extra information that may be of help. There is no doubt that, asking the instructor questions,

talking to classmates, in short, working with others in an environment influences the process and thus the product of the creative task. Therefore, these effects were issues that had to be considered.

The individual videotaped sessions were then watched with each student so that it can be confirmed that the marked evaluations in the assessment sheets are correct and there is consensus between what the student has done and what the observer has understood.

A camera set-up placed in the studio is not something that the students are used to. However, if extra care is given so that the set-up is not too obvious or close to where they sit, in order to keep to the naturalistic environment, effects are assumed to be controlled. The process should be explained to the students beforehand so that method does not interfere with their individual processes.

The assessment of the task dwells on the creativity of the process, the product, and the speed of solving the problem. Moreover, as part of the method of protocol analysis, the students are asked in what kind of place, condition, atmosphere, or situation they can make the quickest, most efficient, and most creative decisions.

3.6.2 Product Assessment

The criteria for the assessment of the product were derived from the literature and were revised according to the curriculum of the third year design studio.

These criteria form the general measures for the assessment of a creative design project.

Additional to these features, certain criteria were also believed to be important and therefore added to the assessment sheet (see Appendix C). Dorst and Cross (2001) stress the importance of “ergonomics”; Purcell and Gero (1998) state the importance of “material”, “texture”, “color” that form the atmosphere of the space (lighting is also an essential part of the atmosphere, so that was included as well, in addition to “conceptual knowledge”, “structure”, “manufacture”, “construction”; and Christiaans (2002) signifies the importance of “workmanship” or craftsmanship.

Following the assessment of the projects by the observer, the instructors met in order to evaluate the drawings. The observer provided explanations regarding the terms involved to prevent any kind of misunderstanding. The results were then compared statistically to see whether there were any significant differences or not. There were no significant differences between the evaluations of the observer and the six instructors [$t=-1,00$, $df=14$, $p>0,05$].

3.6.3 Protocol Analysis (Retrospective Interview)

As one of the most reliable and common methods used for looking into cognitive processes, the protocol analysis with a focus on creativity is used in this study to understand the choices made and their reasons at every stage of the project. The method consists of asking the students open-ended questions regarding stages within their design processes, creative stages,

the methods/ techniques they use to solve problems in general and in this particular one, and thoughts on how they could be more creative. As it is difficult to understand the nature of the imagery process with observation alone, a self-report system was used. Self-report systems are considered a very reliable method and are used extensively in the investigation of imagery in various fields (Finke, 1996; Brain et al., 1998; Dahl et al., 1998; Eastman et al., 2001; Ritz et al., 2002).

Either think-aloud or the retrospective protocol analysis method would have been suitable for this study. The decision on methods was made after a pilot study. The think-aloud method has the advantage of identifying the creative decisions of the student at each stage. More information may be extracted from this method at each step, as there is very little or no time difference between when the decision is made and the verbal representation of it. One disadvantage of this method is that it may interfere with the process itself. That is, the method may alter the next step that follows. Another disadvantage may be that especially some stages may not be clearly understood during the creative process, but only later can the person may make sense of it. Thus, verbal reports that include thinking and talking aloud methods applied concurrent with the problem solved may prove the most helpful (Suwa and Tversky, 1997).

According to Ericsson and Simon (1993), accuracy of retrospective information may be decreased in tasks that take more than 7-10 minutes to complete. However, the retrospective protocol analysis method may be especially useful for this study as, often the designer cannot name the

significant action at the moment that it is made but only retrospectively can s/he identify it. Looking at the whole process after it is finished, one can more easily identify the moment that the crucial and focal concept began to emerge (Dorst and Cross, 2001), and distinguish between the features of the different creative ideas.

In this study, no matter which protocol analysis method is decided upon, the commonly used term, 'choice', is not used mainly for the reason that this term may imply that there are already certain responses to choose from, therefore limiting the understanding of creativity from the start. Whereas, the use in this study is closer to the terms, 'solution' or 'decision'. The decisions made are considered to be divergent, related to the nature of the task given, and not convergent.

Even with the utmost care taken regarding the terminology and methods, as in any assessment method, there are a couple of objections regarding the reliability of verbal reports, without doubt (Ericsson and Simon, 1993). Thus, in this study, the verbal reports are guided in order to retrieve the same amount of information to allow comparisons between subjects.

3.7 A Combination of the Qualitative and Quantitative

Research Methods

The most productive of investigations may be stated to be the ones that make use of both qualitative and quantitative methods and data (Maxwell, 1992). "Observing traces" to understand activity in a space and how the

users utilize that space are important and will help eliminate biases due to the researcher's assumptions (Zeisel et al., 1984: 90), and combining this information with quantifiable data can be very useful in terms of getting a more comprehensive picture of the use of a space. Due to constantly being surrounded by numbers, like the national population or air temperature, we are used to describing and making sense of our world with the aid of numbers. We stress significant aspects of our observations with numbers, which in turn, help us not only to illustrate facts, but also to compare findings on a scale of certain kinds of units (Krathwohl, 1998; Maxwell, 1992; Simonton, 2003).

However, quantitative data on its own, is not helpful if it is not interpreted, and that is where interpretation and qualitative data step in. In research, the matter should not be one of choosing a method, but rather, using the kind of method that will be the most beneficial (Feldman, 1995; Simonton, 2003). In this study, both qualitative and quantitative approaches are utilized although the focus is on the qualitative. In line with the qualitative approach, the study is open to any information that might arise during application without strict presuppositions. The data gathering and analysis processes are rather inductive in that sense. However, this does not disregard the fact that the approach is accurate and objective.

Since this study emphasizes “discovery rather than validation or confirmation”, “the focus is on a process rather than on its product or effect”, and “examples are needed to put *meat* on statistical *bones*”, a primarily qualitative structure is adopted (Krathwohl, 1998: 230). ‘Explanation’, that is

the drive of the quantitative approach, and 'understanding', that is at the heart of the qualitative approach (Maxwell, 1992; Krathwohl, 1998), are both crucial for this study.

Apart from the qualitative-quantitative issue in the investigation, another significant aspect to be discussed is 'validity'. Validity is not solely related to the methods used in the study, but rather involves the integrity of the study, and concerns the character or quality to be assessed with respect to the purposes and techniques (Maxwell, 1992). The internal validities of the assessments were controlled by the Alpha Cronbach tests, and multiple methods were used for triangulation purposes, to cross-check the results obtained, and to increase the precision of estimation of effect size. Furthermore, suggestions for adaptation of the model to other settings were made, and issues to be cautious of were stated at the end of the study.

In order to draw correct and reliable inferences from the brief interview period to the rest of the informant's life which involves several different types of individual perspectives and actions (Maxwell, 1992), the students' backgrounds were investigated and a brief account was given related to their grades, cumulative grade point averages, and demographic data.

3.8 The Pilot Study

The pilot study was done in the format of a single-day studio-work in order to test the effectiveness of the application process. The sample was comprised

of 2003-2004 academic year third year students of the Department of Interior Architecture and Environmental Design at Bilkent University, Ankara, Turkey. The research was conducted throughout one design studio day and participation was a set group of five students (not on a voluntary basis since it can affect the results of the study). Volunteers who are eager to participate can have a greater motivation to work that would in turn influence the whole process. Likewise, if the instructors chose the students, they consciously or unconsciously may choose a particular group such as the hard working, creative, and/ or motivated students. Both situations can affect the natural character of the creative problem-solving process. Thus, the natural sample group of students randomly selected from one in a section was appropriate for the pilot study.

The task was in the form of a design project that took a day. The reason that a short duration was chosen for the task was because the stages of the creative process would be more readily observable, and it would be less likely for the students to forget the nature of their decisions. The fact that more information can be derived from the tasks -due to the beginning and end of the task being close to one another- was the main reason that the duration of the task was kept short. Thus, a short design project involving the design of a semi-public space in order to prevent individualism (the common mistake design students make by attempting to solve the problem for her or himself instead of doing research and thinking about the requirements of the client and project) was thought to be suitable for the effects to be tested. This was believed to enable analysis of how creativity takes place step by step.

Certain revisions were made in the actual application process due to the lessons learned from the pilot study. First, the retrospective interviews (see Appendix D) would be done somewhere away from the other students. The possibility of students overhearing previous students' comments and be influenced by them had to be minimized.

Second, questions 2 and 9 in the retrospective interviews (see Appendix D) had to be revised in terms of wording to clarify what was being asked. The same thing was also true for the question related to 'elaboration' under 'completion', 'perception' under 'sensitivity', and 'disregarding reality' under 'control', in the instructors' evaluations. The internal validities were controlled by Alpha Cronbach tests, and only the ones over 0.8 were taken into consideration. The question on being 'sociable' under 'isolation' was omitted from the observation sheets as a result of these tests.

The last modification that was made regarding the actual application was related to the size of the sample group. The actual task was carried out on fifteen students instead of only five. This will ease the process of generalization.

4. THE EMPIRICAL RESEARCH

The empirical research was carried out in order to test the assumptions in order to understand the process of creativity better. In this chapter, information about the participants, the design brief, task date, and setting of the study are given. Moreover, the analyses of the 'person', 'process', and 'product' are undertaken, and the responses given to the retrospective interviews are discussed in line with the analyses mentioned before to strengthen the integrity of the study.

4.1 Participants

The sample was comprised of third year students of the Department of Interior Architecture and Environmental Design at Bilkent University. There were 15 subjects who were selected by random sampling among 46.

This group of students was comprised of 5 male and 10 female students. The mean age of the students was 20.93, with the youngest being 20, and the oldest, 23. In the group, 11 of the students were from Ankara, the capital of Turkey, 2 from Adana, and the rest were from various cities. The majority of the students were from private high schools (10), and the rest (5) were from public schools. The means of the university entrance exam scores and the Cumulative Grade Point Average's (CGPA's) were found to be 163.282 and 2.45, respectively. Additionally, the previous design studio grades were examined as they may be informative on the current standing of the student.

The grades generally showed little change throughout the semesters, in that, a student (for instance, subject 5) who got a B in the first year usually received similar grades (B, B-, C) along the years (see Table 4.1).

Table 4.1. General Profile of the Students

Sub-jects	Gen-der	Age	Place of Birth	High School Type	U. Entrance Exam Score	CGPA (*)	Previous Design Studio Grades (**)
1	M	22	Ankara	Private	124.020	1.60	(F) D+, C, C-, D+
2	M	22	Zonguldak	Public	166.208	2.94	B-, C+, B, C+
3	F	20	Ankara	Public	149.358	2.21	C-, D+, (D+)C-, (D+)C
4	F	21	Izmir	Private	180.652	2.93	C-, C-, B-, B
5	F	20	Ankara	Private	175.628	2.82	B, B, B-, C
6	F	20	Ankara	Private	168.578	2.22	(F)B, C+, D, C
7	F	21	Adiyaman	Public	202.842	3.27	C+, B, C+, B+
8	F	20	Ankara	Private	172.927	2.68	C, C+, C-, C
9	F	22	Ankara	Private	170.830	2.16	B-, D+, D, D
10	F	20	Adana	Private	165.513	2.48	C, B-, C-, C
11	M	21	Ankara	Public	151.944	2.30	C+, C, D+, D+
12	F	21	Ankara	Private	159.685	2.69	B-, B+, C+, C
13	F	20	Ankara	Private	158.621	2.58	C+, B, C-, C-
14	M	21	Ankara	Private	149.391	1.86	D+, C, D+, C+
15	M	23	Adana	Public	153.034	1.96	(F)C, D+, D, C+, (D+)B-

* CGPA: An average of grades from two or more terms.

** The grade in parenthesis is replaced by the following one after repeating the course.

The highest and the lowest counts for the university entrance exam scores and the CGPA's belonged to the same two students. The relation between the university entrance exam results and the CPGA's seem fairly consistent. Subject 1, who has received 124.020 points from the exam (the lowest within the group) has a CGPA of 1.60, which is well below the passing average of 2.00 and the lowest in the group. Subject 7, on the other hand, has scored 202.842 points from the exam (the highest within the group), and has the highest CGPA (3.27) in the group.

All except one of the public high schools are 'Anadolu Lisesi', which are special public high schools that have very high standards in selecting their students. This brings success in these schools to a level easily comparable to any private high school. Private high schools can be accepted to provide a better education due to their accepting high rank students and receiving a considerable fee to be used for various facilities and technological equipment. (For detailed information on the general profile and behavioral characteristics of the students during their day in the studio, see Appendix E).

4.2 Design Brief

The project was the design of a 'Theme Train', and came out of a prior project that required the conceptual design of a 'Journey' (see Appendix F) which necessitated the design of a pre-constructed volume within the design studio in accordance with a poem, novel/ short story, or movie. The first part of the project was conducted by groups of four students, however, the second project was undertaken by individual students and was therefore suitable for the research study.

For the task, the students were asked to design the public area of the train and draw its perspective. This area could be the lounge, restaurant, or conference area of the train, and was left to the choice of the students. For any public area, it had to be designed for 20 people and had to include a 7m² service area. The plans and sections of the existing train were included in the design brief. However, the students had to propose their own theme and design the interior of the train accordingly. Although the students had not

resolved the layout at that time, it was important for them to start to think about what kind of atmosphere they wanted to have within the train. Thus, the aim of the perspective was to make them start thinking about these issues. In order to do this, the students first had to form a concept in their minds that would help them in defining the theme and the atmosphere of the space. Since the students had not begun the planning of the layout of the train, this task aimed to investigate what kind of space the students visualized prior to any kind of planning activity. In this way, it was expected that they could be more flexible and creative in their thinking (Pereira, 1999).

4.3 Task Date

The task date was especially chosen for a number of reasons. First, it was right after the research phase of the project. Therefore, the subjects have acquired new information to use in designing several different fundamental elements regarding the project. Moreover, significant design decisions are usually made at the beginning of a creative process as stated (Jones, 1992; O'Neill and Shallcross, 1994; Kristensen, 2004), also confirmed by the pilot study. It was expected that on this day, a useful concept could be found and judgments regarding the layout and atmosphere could be made. Finally, the task had to be completed within a day and the products were available at the end of the design studio period for assessment purposes. Throughout the semester, the students do not hand in their products every day, and this phase was suitable for a one-day project.

The task was carried out during a single studio day, and the whole process within that day was videotaped. The students began working on the task at

10:40 a.m. and continued until about 12:30 p.m. when most took their lunch-breaks. Around 1:30 p.m. most of the students were back at their desks continuing to work on the problem. The camera was on throughout the day even when all the students were out, since it was important to record who came back when and how long each student took a break. The task was due for 4:30 p.m. and all of the students submitted their drawings at that time.

4.4 Setting of the Study

The third year design studio for 46 students in the Department of Interior Architecture and Environmental Design was the setting for this study. This studio is a good representative of all third year design studios at Bilkent University in terms of spatial characteristics (see Figure 4.1).

The tables were arranged into groups of five in a way that the camera would be able to view each one of the students clearly and their works in detail. Three cameras taped the three groups in detail, and one camera was placed further away to include all of the groups at once and the rest of the studio, in order to achieve a better idea about the relationships between the students and their use of the studio environment (see Figure 4.2).



Figure 4.1. The Setting of the Design Studio

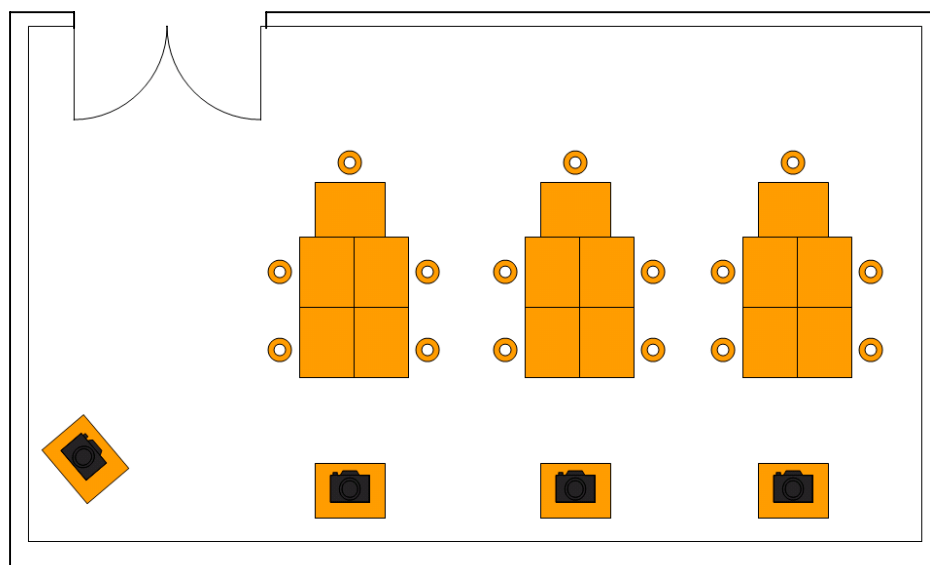


Figure 4.2. Schema Showing the Camera Positions

4.5 Analysis of the 'Person'

The observation was carried out throughout the single day on which the task was given. The observer watched each student throughout the day and recorded the scores. However, as it is not possible to catch each movement of the students at all times, the videotapes were helpful in filling in several of the items. The tapes were watched and assessed for each individual student and the observation sheets were filled accordingly (see Appendix A).

The 'person' part consists of 'originality', 'completion', 'self-courage', 'sensitivity', 'negativity', 'isolation', 'control', and 'humor' components (see Table 4.2 and Appendix A). 'Originality' consists of 8 items and depends on observational characteristics such as, not being conventional, not having a simple way of approaching problems, and the ability to produce products without much difficulty. These factors can be observed from the gestures, facial expressions of the students in addition to the questions they ask and the opinions of the teacher. The results of this section are very similar to that of the pilot study except for the 'isolation' category which turned out to be less creative compared to the previous results.

In total, the students rated 20.01% creative and 79.99% non-creative on the overall score of originality. The students unanimously rated non-creative in items such as, 'being unconventional' and 'having wild, silly ideas'.

Table 4.2. The Comparison of the Results of All Students on the Observational Characteristics of the 'Person' in Percentages

	Creative	Non-Creative
Originality	20.01	79.99
Completion	56.65	43.35
Self-Courage	48.61	51.39
Sensitivity	49.34	50.66
Negativity	32.02	67.98
Isolation	15.56	84.44
Control	68.32	31.68
Humor	46.66	53.34
Mean	42.14	57.86

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

'Completion' consists of 6 items such as, starting a given project right away, not giving breaks until her/his work is finished, and mingling with others in the studio. Regarding this category, the creativity level was distributed evenly among the group. The students were rated 56.65% creative and 43.35% non-creative regarding this category.

'Self-courage' consists of 17 characteristics such as, being extrovert, asking for help, and being adventurous and positive in complex situations. Except for items such as, 'willing to take risks', 'being adventurous', 'being hopeful with complex tasks', 'not being bound to habits', 'and being non-conforming', the creativity level was distributed evenly among the group. In addition, in the 'being open' and 'not asking for help' items, the students all rated creative. Overall, 48.61% was the score for creativity, and 51.39% non-creative.

'Sensitivity' depends on 5 characteristics such as being emotionally sensitive, being sensitive to the things that happen in the environment, and being interested and curious about the surrounding. In this category, the students were distributed almost evenly (7 creative, 8 non-creative or vice-versa) among all items. Overall, the group was found to be 49.34% creative and 50.66% non-creative.

'Negativity' consists of 5 items on unconstructive characteristics that may be found in individuals during the creative process, such as being annoying or being totally ignorant of others in the same learning environment. Although not many, some students occasionally showed rude behavior towards their friends or the observer. This actually shows that these students scored high in creativity in this category. Overall, the total score for this item was found to be 32.02% creative and 67.98% non-creative.

Characteristics such as being estranged or being able to work with others (6 items) form the 'isolation' category. This characteristic of the students could easily be observed while they were working. There were students who preferred to work alone in every class, while some preferred to occasionally work alone, and some always working in groups of two persons or more. These students were observed taking into consideration their behavior and cooperation with other students. In addition, their responses to the related question in the retrospective interview in which they were asked the reason of their choice were examined. For this category, the total creativity level of the group was 15.56% and 84.44% non-creative, with the 'independent of judgment' and 'uncooperative' items being unanimously non-creative. Most

students noted that they liked working alone and that they could work more efficiently and creatively that way, but showed signs of excessive non-constructive communication in the studio from time to time. This may have lowered their creativity score.

'Control' is defined by 4 characteristics such as being defensive, and being balanced. The students who did not feel the need for defending themselves against questions of their friends or the observer, and did not show signs of defensiveness in the studio were identified as more controlled. The student group was found to be 68.32% creative and 31.68% non-creative for this category.

'Humor' is comprised of 3 characteristics that depend on the individual's spontaneous and creative thinking, and consists of characteristics such as being humorous or childlike. The group rated almost evenly for this item, and 46.66% creative and 53.34% non-creative was the total score. In total, for the 'creative person' category, the total group scored 42.14% creative and 57.86% non-creative.

When each of the students are examined for creativity, it can be seen that none of the students have gone over 65.59% mean creativity (see Table 4.3). However, most of the students have received a 100.00% score in at least one of the categories. In the 'originality' category, the highest mark is rather low -50.00% creative- and there are six students who have scored 0.00% creative in this category. Seven students have scored 100.00% creative in 'completion', which is the most number of full percentage scores

among the categories alongside 'control'. This was expected as all students were required to complete and submit a certain task that day for assessment. Therefore, none of the students left without handing their perspectives in though they were not on equal levels of completeness. In the 'self-courage' category, the highest mark is 94.11% creative, and the lowest is 11.76%. There are no 0.00% scores in this category. The students have scored on two ends of the creativity scale in the 'sensitivity' category. There are five students who have scored 100.00% creative, and six students who have scored 0.00% creative. This is interesting as it shows that, there is a bi-polar relationship regarding this category unlike the others, that is, the students were found to be either very sensitive, and therefore creative, or not at all. Under 'negativity', there are three students who have scored 100.00%, and six who have scored 0.00% creative. However, this item depends on impolite behavior of the students towards their friends or instructors, and especially in Turkey, this is not a very common behavior style. Therefore, it is expected that there are few students who show this type of behavior. In the 'isolation' category, the highest score is 50.00%, however, it was hard to be isolated as the students were sitting in groups. Still, extroverted and introverted approaches could easily be observed in the behavior of the students. 'Control', as mentioned before, was a highly rated category with seven 100.00% and only three 0.00% creativity scores. Most students were calm, balanced, and in charge of what they were doing. Thus, it is not surprising to see that the score in this category is rather high. Finally, 'humor' is a category in which there were only three students who were all male that scored 100.00% creative, and five students who were all female scored 0.00%. Humor was not something that was seen in the students to a large extent,

and it can be stated that female students appear to be the less humorous according to the observations.

Table 4.3. The Creativity Scores of Each Student on the Observational Characteristics of the 'Person' in Percentages

Sub-jects	Originality	Comp-letion	Self-Courage	Sensi-tivity	Negativity	Isolation	Control	Humor	Mean
1	25.00	16.66	11.76	0.00	40.00	16.66	25.00	0.00	16.88
2	50.00	100.0	41.17	80.00	100.0	50.00	0.00	0.00	52.64
3	0.00	0.00	17.64	0.00	60.00	16.66	0.00	33.33	15.95
4	37.50	100.0	17.64	100.0	0.00	0.00	100.0	33.33	55.91
5	50.00	83.33	76.47	60.00	0.00	0.00	75.00	100.0	55.60
6	0.00	66.64	17.64	0.00	20.00	16.66	100.0	0.00	27.61
7	37.50	100.0	70.58	100.0	0.00	16.66	100.0	100.0	65.59
8	25.00	0.00	23.52	0.00	20.00	0.00	100.0	0.00	21.06
9	25.00	100.0	29.41	100.0	0.00	16.66	100.0	33.33	50.55
10	25.00	100.0	64.70	100.0	20.00	16.66	75.00	100.0	62.67
11	0.00	100.0	23.52	100.0	0.00	16.66	75.00	0.00	39.39
12	0.00	0.00	52.94	60.00	0.00	16.66	100.0	66.66	37.03
13	0.00	100.0	58.82	40.00	20.00	16.66	100.0	66.66	50.26
14	25.00	0.00	64.70	0.00	100.0	16.66	75.00	66.66	49.75
15	0.00	0.00	94.11	0.00	100.0	16.66	0.00	100.0	45.09

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

4.6 Analysis of the 'Process'

The assessment of the process was carried out on two different levels. The first assessment sheet that was used to determine the creativeness of the process of each student (see Appendix B.1). It was designed as a set of binary features derived from previous research and literature (Guilford, 1968; Feldhusen, 1993; Isaksen et al., 1993b; Bailin, 1994; O'Neill and Shallcross, 1994; Candy and Edmonds, 1999; Cropley, 1999; Beattie, 2000; Dorst and Cross, 2001). A second assessment sheet was used to determine the stages

of the creative process and the duration of each throughout the task for each student (see Appendix B.2).

4.6.1 Components of the Creative 'Process'

The 'process' part in the first assessment sheet, consists of 'originality', 'completion', 'self-courage', 'sensitivity', 'negativity', 'identification', and 'movement' components (see Table 4.4 and Appendix B.1). Originality is a category consisting of 10 characteristics such as, imitating friends, or creating new materials or tools. For this category, the student group was found to be 22.00% creative and 78.00% non-creative. In the item 'finds new ways of solving problems', there was only one student who was rated creative.

Table 4.4. The Scores of All Students on the Observational Characteristics of the 'Process' in Percentages

	Creative	Non-Creative
Process		
Originality	22.00	78.00
Completion	44.45	55.55
Self-Courage	22.85	77.15
Sensitivity	40.00	60.00
Negativity	23.32	76.68
Identification	46.70	53.30
Movement	49.34	50.66
Mean	35.52	64.48

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

'Completion' is comprised of 6 items and identifies behavior such as, being completely involved in the project, or looking around for ideas. The students who did not choose to give breaks to finish the activity, were the ones identified as more creative for this category. The group scored 44.45% creative and 55.55% non-creative.

This relation was reversed in the following item of 'self-courage' that consists of 7 characteristics such as, being independent of others in decisions, or freely and easily transferring thoughts onto the project. The students who occasionally asked questions on the structure of the project were accepted as more creative compared to the students who constantly asked the observer about what to do and relied too much on the instructor's critique, in this category. In items such as, 'need to meet challenge' and 'attempting difficult tasks', none of the students were found to be creative. Overall, the students were found to be 22.85% creative, and 77.15% non-creative.

In the 'sensitivity' category, 4 characteristics such as, fully reacting to experience and showing increasing awareness in the environment were looked for. In total, the group scored 40.00% creative, and 60.00% non-creative.

Characteristics such as being rebellious during the process, sloppy, or capricious define 'negativity' (10 items). Students who were indifferent to rules and warnings inside the studio, or who did not care about the mess s/he made around her/him were accepted as more creative for this category. The group scored 23.32% creative, and 76.68% non-creative as the students did

what they were told to do and were careful about keeping the studio tidy while working.

'Identification' involves 2 items such as, being connected to the work being done, and reflecting this with gestures while working. Without being aware of themselves, the students mimicked bodily movements of someone moving inside their model or drawing, as if to feel what it would have been like to be in that room. The group rated evenly for this category with the score of 46.70% creative and 53.30% non-creative.

Being flexible in bodily movements define the 'movement' category (5 items). Students who were not working in a rigid posture, and who changed places in order to get material or cut a large piece of cardboard, for example, were accepted as more creative in this category. The group rated 49.34% creative and 50.66% non-creative in this category, as the students were not that comfortable in their movements in the studio. In total, the students rated 35.52% creative and 64.48% non-creative, which is a lower score compared to the 'person' item.

When the creative process of each of the students is observed, several items stand out due to the interesting distribution of scores among the students. In the 'originality' category, seven students scored 0.00% creative, and the highest score was 70.00% (see Table 4.5). Likewise, under 'completion', seven students rated 0.00% creative and the highest score was 80.00%. In 'self-courage', there was one student who scored 100.00%, however, eight who scored 0.00%. The number of students who scored 100.00% increases

to four in the 'sensitivity' item, and the ones scoring 0.00% drops to seven, with the rest of the students' scores regularly distributed between 25.00%, 50.00%, and 75.00%. Under negativity, there were two students who rated 100.00%, and seven who rated 0.00%. However, this is not surprising due to the information that negative behaviors are highly unwelcome in the Turkish society especially towards instructors. Thus, this finding may be a result of this cultural characteristic. In the 'identification' item, six students scored 100.00% and nine students scored 0.00% creative. This was one of the characteristics in which the students were either at one end or the other of the creativity measure. Although all of the perspectives are expected to be a result of an identification process, it does not appear to be that way, as the majority of the students did not show signs of identification with the task.

Seven students scored 100.00%, and only two scored 0.00% creative in the 'movement' category. The rest of the students' scores were consistently divided between 20.00%, 40.00%, and 60.00%. Considering the means, the lowest score was 5.71%. The highest score was 64.69% and belonged to the student who also had one of the highest scores in the CGPA, University Entrance Exam, and *Person* assessment.

Table 4.5. Creativity Scores of Each Student on the Observational Characteristics of the 'Process' in Percentages

Sub-jects	Originality	Completion	Self-Courage	Sensitivity	Negativity	Identi-fication	Movement	Mean
1	0.00	16.66	0.00	25.00	20.00	0.00	60.00	17.38
2	30.00	50.00	14.28	100.0	30.00	100.0	20.00	49.18
3	10.00	0.00	0.00	25.00	50.00	0.00	100.0	26.42
4	30.00	30.00	71.42	0.00	0.00	100.0	0.00	33.06
5	30.00	80.00	42.84	100.0	0.00	100.0	100.0	64.69
6	0.00	0.00	0.00	0.00	0.00	0.00	100.0	14.28
7	70.00	70.00	100.0	100.0	0.00	0.00	60.00	57.14
8	0.00	0.00	0.00	0.00	20.00	0.00	20.00	5.71
9	0.00	0.00	0.00	0.00	0.00	0.00	40.00	5.71
10	30.00	30.00	57.12	100.0	10.00	100.0	100.0	61.01
11	0.00	0.00	0.00	0.00	0.00	100.0	0.00	14.28
12	40.00	40.00	14.28	75.00	0.00	100.0	100.0	52.75
13	0.00	0.00	33.33	0.00	20.00	0.00	60.00	16.19
14	40.00	40.00	0.00	0.00	100.0	0.00	100.0	40.00
15	0.00	0.00	0.00	50.00	100.0	0.00	100.0	35.71

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

4.6.2 Stages of the Creative 'Process' (The Analysis of the 5R Stages)

The assessments of the stages of the process were done according to a binary assessment sheet of features derived from previous research (see Appendix B.2). Certain behavior patterns are expected to occur at each stage, and these also define the ending of one stage and the beginning of the other (see Section 2.2). Among other features, the transition from 'readiness' to 'reception' can be most clearly identified by beginning to observe the task at hand and looking intently for inspiration, and the one from 'reception' to 'reflection' was marked by the ending of observation and the beginning of externalization of ideas. 'Revelation' can be identified by increasing levels of representation and the solution taking on physical entity as well as a certain amount of imagery and looking around. Finally, 'recreation' can be recognized by the resolution of ideas, and the finalization of details (like the

beginning of rendering and effort in showing texture and materials for this particular project).

For almost all of the students, the stages were almost uniformly divided in terms of the time spent at each (see Figure 4.3). On average, 48 minutes were spent in the 'readiness' stage, 81 in the 'reception' stage, 57 in the 'reflection' stage, 55 in the 'revelation' stage, and 35 in the final stage of 'recreation'. The students usually spent more time in the reception stage compared to the final stage of 'recreation', which means that they did not have time to finalize their perspectives and prepare them for assessment. Only two students (subjects 4 and 5) could come closer to finishing their perspectives, and they were among the few who had spent more time (75 and 60 minutes, respectively) on the final stage of 'recreation' compared to the previous stages. However, these two students had also spent a considerable amount of time (45 minutes each) during their 'readiness' stage gazing around in a daydreaming-like mode, which suggested their use of imagery at that time. The instructors were in agreement on the fact that these two projects were among the most creative (see Figures 4.4 and 4.5). Therefore, not only the time that is spent at each stage, but also, how effectively this time is used is significant. The students who used imagery did not spend time wandering around or talking to others, but basically sat at their tables thinking, as opposed to the ones found least creative (see Figures 4.6, 4.7, 4.8, and 4.9).

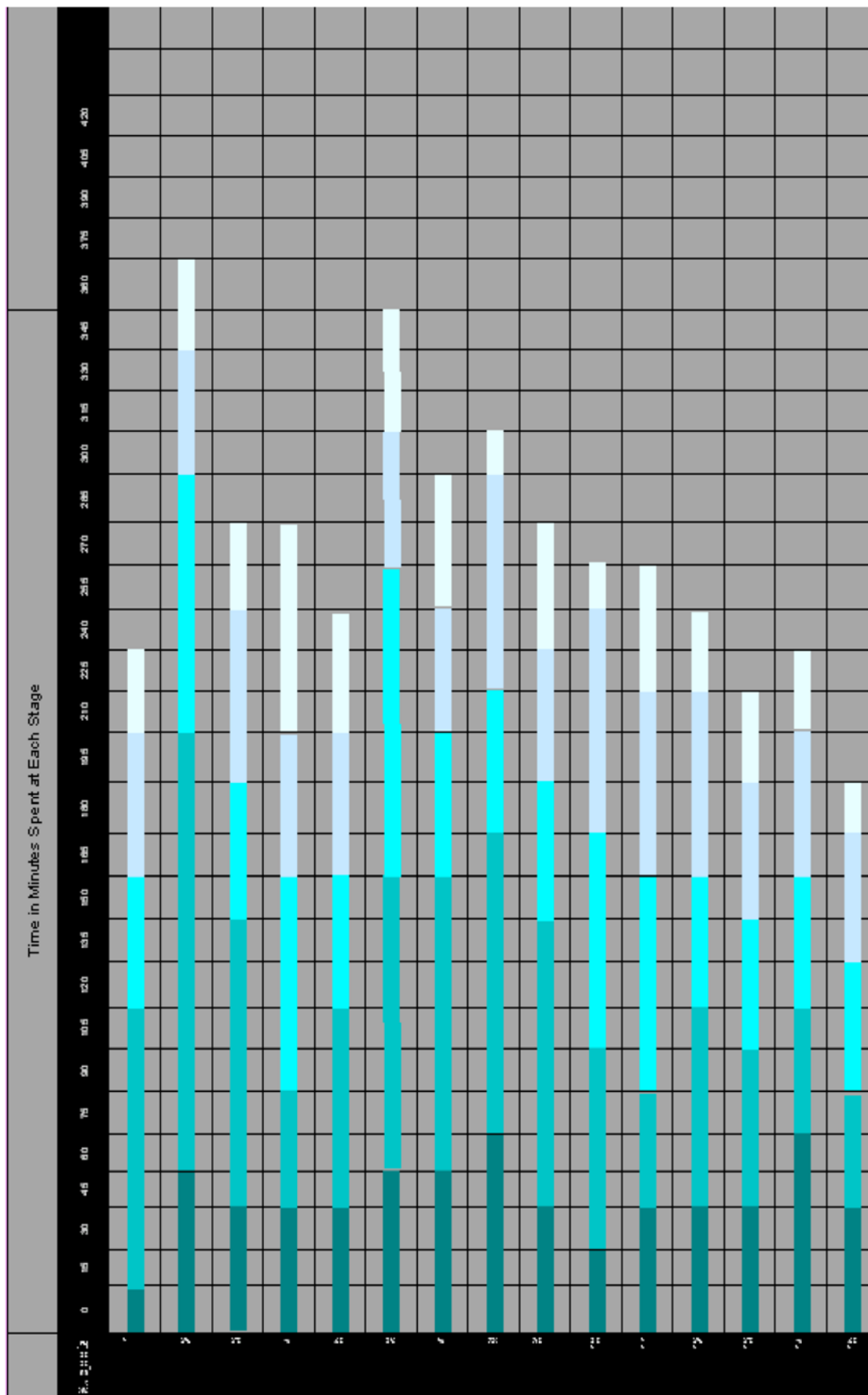


Figure 4.3. Duration of the Stages in 5R's (Gantt Chart)



Figure 4.4. One of the Two Projects Scoring Most Creative



Figure 4.5. One of the Two Projects Scoring Most Creative



Figure 4.6. Students Wandering Around the Studio



Figure 4.7. Students Using Imagery



Figure 4.8. One of the Two Projects Scoring Least Creative



Figure 4.9. One of the Two Projects Scoring Least Creative

4.7 Analysis of the 'Product'

The products were assessed by the design instructors as well as the observer, and results from both parties were found to be in keeping (see Appendix C). The instructors and the observer graded each student's work independently; thus, the possibility of affecting each other while grading the products were eliminated. The raw averages of the two scores were calculated for the final performance score, and a 'paired sample t-test' was carried out to assess the difference between the instructors and the observer's rating on the product. In total, no significant difference was found between the responses [$t=-1.00$, $df=14$, $p>0.05$].

The 'product' part consists of the individual assessments of 'product creativity', 'design elements', 'unifying principles', and 'spatial qualities' (see Appendix C). The definitions of each term under these titles were given to the instructors to ensure mutual agreement on each item. Instead of a creative - non-creative dichotomy, here the evaluation relies on a scale of five items (poor, poor-average, average, average-excellent, excellent) as the product characteristics necessitate a more detailed categorization.

In the 'product creativity' category (10 items), there were only two students who scored at all in the excellent column (both 20.00%) (The scores in the excellent column are mentioned as they are few in this part of the assessment). There were, however, four students who scored 100.00% poor. There was only one student who scored excellent (14.28%), and six students who scored 100.00% poor under 'design elements' (7 items). In the category of 'unifying principles' (7 items), three students scored in the excellent

category (28.57%, 14.28%, and 14.28%), and six students who scored 100.00% poor. Under 'spatial qualities' (11 items), there was one student who scored excellent (36.36%), and six who scored 100.00% poor. In all of the categories, the same two students (subjects 3 and 9) scored in the excellent category and the same six students (subjects 6, 7, 8, and occasionally 1, 13, and 14) 100.00% poor with little difference (see Table 4.6).

Table 4.6. The Scores of Each Student on the Observational Characteristics of the 'Product' in Percentages

Subjects	Product Creativity					Design Elements					Unifying Principles				
	Poor (1)	(2)	(3)	(4)	Excel- lent (5)	Poor (1)	(2)	(3)	(4)	Excel- lent (5)	Poor (1)	(2)	(3)	(4)	Excel- lent (5)
1	90.00	10.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
2	10.00	40.00	40.00	10.00	0.00	14.29	0.00	28.57	57.14	0.00	14.29	28.57	14.29	28.57	0.00
3	0.00	0.00	30.00	50.00	20.00	0.00	0.00	28.57	71.42	0.00	0.00	14.28	14.28	42.85	28.57
4	0.00	0.00	50.00	50.00	0.00	28.57	0.00	57.14	14.28	0.00	14.28	14.28	28.57	42.85	0.00
5	10.00	30.00	60.00	0.00	0.00	42.85	42.85	14.28	0.00	0.00	57.14	14.28	14.28	14.28	0.00
6	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
7	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
8	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
9	90.00	0.00	0.00	10.00	0.00	71.42	14.28	14.28	0.00	14.28	71.42	0.00	14.28	0.00	14.28
10	30.00	50.00	20.00	0.00	0.00	14.85	85.71	0.00	0.00	0.00	14.28	57.14	28.57	0.00	0.00
11	90.00	10.00	0.00	0.00	0.00	57.14	28.57	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
12	0.00	0.00	50.00	30.00	20.00	14.28	14.28	57.14	14.28	0.00	100.00	0.00	0.00	0.00	0.00
13	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
14	90.00	10.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	71.42	0.0	14.28	0.00	14.28
15	60.00	40.00	0.00	0.00	0.00	28.57	28.57	42.85	0.00	0.00	14.28	57.14	28.57	0.00	0.00

Continued on next page.

Table 4.6 (cont'd)

Spatial Qualities					Mean				
Poor (1)	(2)	(3)	(4)	Excel- lent (5)	Poor (1)	(2)	(3)	(4)	Excel- lent (5)
100.00	0.00	0.00	0.00	0.00	75.00	25.00	0.00	0.00	0.00
9.09	18.18	54.54	9.09	0.00	11.91	21.68	34.35	32.06	0.00
9.09	0.00	9.09	45.45	36.36	2.27	3.57	20.48	52.43	21.23
18.18	36.36	36.36	9.09	0.00	15.25	12.66	43.01	29.05	0.00
18.18	63.63	18.18	0.00	0.00	32.04	37.69	26.68	3.57	0.00
100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
81.81	18.18	0.00	0.00	0.00	78.66	8.11	7.14	2.50	3.57
36.36	63.63	0.00	0.00	0.00	23.87	64.12	12.14	0.00	0.00
81.81	18.18	0.00	0.00	0.00	60.80	32.04	7.14	0.00	0.00
18.18	45.45	27.27	9.09	0.00	11.68	22.07	47.88	13.34	5.00
100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	0.00	0.00	97.50	2.50	0.00	0.00	0.00
45.45	27.27	18.18	9.09	0.00	37.07	31.10	22.40	9.41	0.00

The means of the product creativity (1.88), design elements (1.81), unifying principles (1.67), and spatial qualities (1.54) were added up and the total creativity score that was derived from these four categories was 1.73 on a 5-point scale. That is, the total result was found to be between 'poor' and 'average'. The distribution of the score among the items shows interesting results. Although very few students have scored 'excellent', in the category of 'product creativity', there was one student who scored excellent in the items 'flexibility', 'elaboration', 'ability to answer needs', and 'open-endedness'. The same was true for 'repetition', 'unity', and 'harmony' in the category of 'unifying principles', and 'design details', 'presentation', and 'craftsmanship' in the 'spatial qualities' category (see Table 4.7).

The students did not score very high in any of the items, but they liked dealing with furniture, as was also found in the previous pilot study. The fact that the students were enjoying dealing with the furniture and its details instead of plans or sections could clearly be observed in the camera recordings. Although the students put emphasis on furniture and details, it was surprising that they neglected the design of lighting fixtures ('light'), material ('material use') and the use of 'value' and 'color' in their projects. Especially lighting and material, which are important features for interior architects were not one of the popular subjects. This evaluation enabled to see which subjects the students needed assistance, what they liked to deal with, and which topics they are successful and creative at during the creative process.

Table 4.7. The Distribution of the Results of All Students on the Observational Characteristics of the 'Product' in Percentages and Means

Product	Poor (1)	(2)	(3)	(4)	Excellent (5)	Mean
Product Creativity						1.88
Value	46.7	20.0	20.0	13.3	0.0	2.00
Appropriateness	60.0	6.7	13.3	20.0	0.0	1.93
Flexibility	60.0	13.3	13.3	6.7	6.7	1.86
Fluency	53.3	20.0	20.0	6.7	0.0	1.80
Novelty	60.0	6.7	33.3	0.0	0.0	1.73
Originality	60.0	13.3	26.7	0.0	0.0	1.66
Elaboration	53.3	13.3	13.3	13.3	6.7	2.06
Ability to Answer Deficiencies	60.0	0.0	6.7	26.7	6.7	2.20
Ability to Redefine	73.3	6.7	0.0	20.0	0.0	1.66
Open-Endedness	60.0	6.7	20.0	6.7	6.7	1.93
Design Elements						1.81
Line	46.7	0.0	26.7	26.7	0.0	2.23
Shape and Form	53.3	13.3	20	13.3	0.0	1.93
Space	53.3	13.3	33.3	0.0	0.0	1.80
Texture	60.0	20.0	6.7	13.3	0.0	1.73
Value	53.3	26.7	13.3	6.7	0.0	1.73
Color	60.0	13.3	13.3	13.3	0.0	1.80
Light	73.3	13.3	13.3	0.0	0.0	1.40
Unifying Principles						1.67
Repetition	46.7	0.0	20.0	26.7	6.7	2.46
Variety	46.7	26.7	20.0	6.7	0.0	1.86
Rhythm	60.0	26.7	6.7	6.7	0.0	1.60
Balance	40.0	33.3	13.3	13.3	0.0	2.00
Emphasis	73.3	13.3	13.3	0.0	0.0	1.40
Unity	53.3	13.3	6.7	20.0	6.7	2.13
Harmony	60.0	6.70	26.7	0.0	6.7	1.86
Spatial Qualities						1.54
Concept Execution	60.0	33.3	0.0	0.0	6.7	1.60
Atmosphere/ Ambiance (Material, Color, Texture, and Lighting)	40.0	33.3	13.3	13.3	0.0	1.66
Planning/ Layout	40.0	40.0	13.3	6.7	0.0	1.86
Building System And Components (HVAC, Sound Systems)	86.7	6.7	6.7	0.0	0.0	1.20
Ergonomics (Health, Safety, Comfort)	60.0	13.3	13.3	13.3	0.0	1.80
Use of Standards	73.3	0.0	26.7	0.0	0.0	1.66
Furniture	53.3	33.3	6.7	6.7	0.0	1.80
Design Details	53.3	26.7	13.3	0.0	6.7	1.80
Material Use	60.0	26.7	6.7	6.7	0.0	1.60
Presentation	60.0	13.3	6.7	13.3	6.7	1.93
Craftsmanship	60.0	13.3	13.3	6.7	6.7	1.86
Total	57.51	16.18	14.85	9.33	2.1	1.73

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

4.8 Analysis of ‘Retrospective Interviews’

The findings derived from the retrospective interviews were categorized under the headings of, ‘Tools and Problem-Solving Methods’, ‘Inspiration’, ‘Use of Time and Creativity’, ‘Assessment of the Projects’, ‘Context/Environment’, and ‘Curriculum’. These headings were not previously determined, but came out as a result of frequently mentioned topics by the students during their interviews.

4.8.1 ‘Tools and Problem-Solving Methods’

Regarding the amount of imagery and representation used, only two students said that they used more than 70% imagery and less than 30% representation. One of these students verbalized this as such:

“I start the project by imagining the space. I have lots of ideas in my mind, but then sometimes I cannot show them in my drawings.”

Seven of the students stated that they solved 70% of the problem in their minds and only represented 30% (see question 1 in Appendix D). These students stated that they had difficulty in representing their thoughts:

“Sometimes it gets difficult to show the instructors what I’ve visualized in my mind, so I tell them verbally, and show pictures from magazines and books.”

Another student mentioned the importance of verbal communication during critiques on their projects:

“I’m better at verbal communication. It’s easier for me to tell the instructor what I want to do rather than draw it because sometimes I cannot reflect what’s in my mind on paper.”

Following this group, five students stated that they used imagery and representation equally throughout the process. One student stated:

“It depends on the problem. I sometimes visualize the space in my mind and solve layout and concept problems in my head... but other times, I start solving the layout by sketching... I even use both at the same time.”

Only one student said that he used 30% imagery and 70% representation.

He stated that he usually solved design problems by means of representing his thoughts one way or another:

“I think by sketching miniature versions of the layouts or certain design elements in the project. It’s easier that way. Occasionally, I might come to a conclusion in my mind.”

All of the students stated that they usually used the same amounts representation and imagery, and representation techniques in all projects (see question 4 in Appendix D) (see also Figure 4.10).

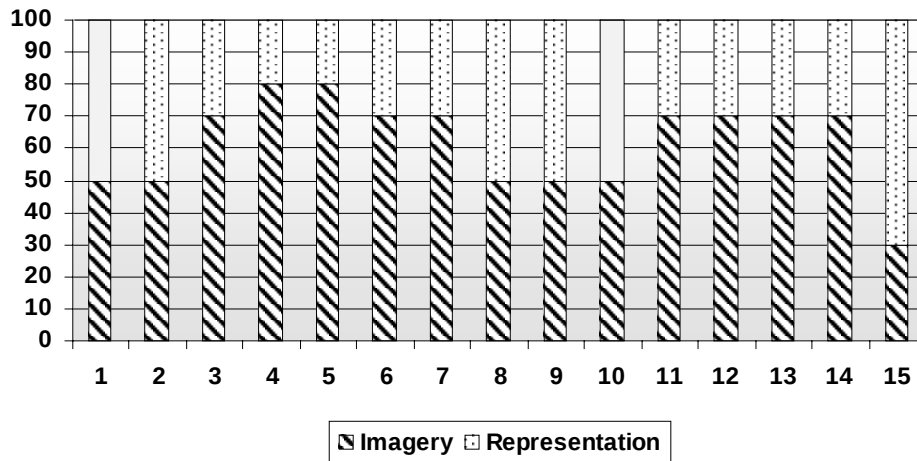


Figure 4.10. Quantity of Representation and Imagery for Each Student

Most of the students mentioned that they liked visual two-dimensional representation the most (see question 5 in Appendix D). Drawings were stated as one of the important methods that helped students visualize the space three-dimensionally (see question 2 in Appendix D). Although only one student mentioned fully rendered perspectives, nine of the students mentioned different types of drawings -usually prepared for a particular type of assessment- as the most helpful aids. This might mean that students need outside motivation like juries or class-work for the development of their projects. It is also likely that it means they are missing out on the important skill of sketching that they can carry out anywhere and will be quite helpful in their professional lives, as a means of representation as well as creative problem-solving. Although it is becoming simpler to use computer programs each day, it is important for a designer to develop the skill of sketching to be able to demonstrate on-the-spot ideas and solutions to clients, collaborators, and workers. Perhaps this could be reflected onto the curriculum and more emphasis could be given to quick sketching.

Colorful representation has been mentioned as a useful method of imagining the ideas. One student especially stated that drawing by using several colors and textures, was very helpful to her in solving design problems. However, according to the instructors, the use of color in the projects are not as developed as they should be. Since use of color aids delivering ideas on texture and atmosphere as well, this is an important skill that should be developed, and stressed in the curriculum.

Only three students mentioned models or three-dimensional objects as a means of helping to develop the creative process. Among other ways to facilitate the problem-solving process, computerized drawings were mentioned by two students as it was easy to draw on computers, easily see details of the project, and make changes on them as necessary. Words, or oral representation was one of the most popular methods among students, as according to one student, “sometimes drawings cannot deliver ideas effectively”. This may mean that some students use imagery more than the representation of their ideas.

4.8.2 ‘Inspiration’

Design magazines and books, the internet, and critiques are the most frequently mentioned inspiration sources by the students (see questions 3, 6, and 7 in Appendix D). Apart from these, aspects related to the project (designing a theme train) itself like design details and the fact that it is a vehicle, designing of the lighting system, colors, themes, and chosen concepts were among common answers.

Regarding the project, other features were also mentioned as aspects that were inspiration sources. Issues such as, creating a maximally equipped space out of a constrained one, were seen as challenges that forced the students to push their creative limits. However, one student mentioned his fear of grades as a factor shaping the whole process, and the assessments as the features that motivated him to develop the project, as he was afraid of getting low grades. Regarding this topic he said:

“I’m afraid of getting low grades. This sometimes prevents me from coming up with good ideas. But at the same time, it motivates me and makes me work faster.”

It was also mentioned by the students that they felt increasingly competent as interior architects as they overcame the various problems throughout the process that the average person could not solve. However, the students repeatedly stated that they did not feel competent in representing their ideas on paper due to an inhibition related to sketching and thinking by sketching. One student stated:

“I’m just not good at drawing... especially perspectives.”

Almost all students stressed the importance of critiques for effective reasons for turning points and milestones. Apart from this answer, one student stated that at each stage she rethinks her solution and assesses it according to the question of whether she would like to spend time in the space that she has designed or not. Outside inspiration sources like design books, design magazines, and the internet were also mentioned as being effective on the process by giving rise to radical changes in the normal flow of the creative process.

4.8.3 'Use of Time and Creativity'

Regarding issues related to the 'most creative idea', a common answer regarding the question about the stage at which the students believed they were the most creative was, towards the end of the day when they worked on finalizing their drawings (see questions 8 and 9 in Appendix D). This has also been identified as a stage at which utmost representation and minimum imagery takes place, as can be observed from the tapes.

Consistent with the findings of the pilot study, the final stages are believed to be the ones reaching the peak creativity levels. The students frequently mentioned working on the details while trying to finalize the project as the phase at which they believed they were the most creative. Other answers were related to the influence of assessment times and constraints being effective on creativity, and three students specifically stated that, as they got closer to running out of time, they sometimes got some of the most creative ideas that they had not thought about before. One student stated:

“When I have more time, I am more relaxed... but as I come closer to the submission time I frequently have creative thoughts come to me.”

Another student specifically stated that he was the most creative at the last stage before the jury, as he was afraid of getting low grades. This finding is consistent with the stages of creative problem-solving -the 5R's- which explains that 'revelation' and 'recreation' take place close to the finalization of the process (O'Neill and Shallcross, 1994).

Most students also mentioned the importance of finding the theme or concept that would help them develop their projects on a number of levels, as being an additional creative stage. The selection of the theme or concept is one of the first steps that one takes before elaborating on the process, and is one that also resulted in high levels of creativity according to the students.

Regarding the responses on things that would make them 'work more efficiently', the students mentioned inspirational ideas, an environment without interruptions, more time and less pressure of deadlines, research, critiques, television, design magazines, a warmer environment with less pressure which is nevertheless disciplined, and drawing more sketches (see question 11a in Appendix D). A recurring issue that came up in the interviews was that, the students found their decisions regarding the color scheme to be the most creative decision they had throughout the process.

Regarding issues related to 'the most time spent', the students' responses were quite consistent. Following the initial stage in which the students are first introduced to the project, they are expected to choose a theme or concept to guide them through the process and reflect their opinions on what the general atmosphere of the environment should be like. Afterwards, students concentrate on reflecting this theme onto the project, which is mentioned to be the stage at which the students spent the most time (see question 10 in Appendix D). This has also been identified as a stage at which utmost imagery and minimum representation takes place, as can be observed from the videotapes.

The act of drawing a perspective has also been stated to be very difficult as most of the students had a hard time remembering the rules and drawing one without distortion. Twelve students stated that they spent the most time during the planning phase of the perspective drawings they prepared on the day of the application (see Figure 4.11).



Figure 4.11 Students Planning the Perspective

Regarding the responses on things that would make them work more creatively, the students mentioned, issues that were not that much different than the things that would make them more efficient (see question 11b in Appendix D). Among the responses were, having more time, doing group-work, less pressure of deadlines, preparing more drawings and sketches, more critiques, more research, a friendlier environment with music, and more

exposure to design magazines and books. One student commented on the importance of having more time:

“If I had more time, I could get things done. But, I never have enough time. I can never finish the details.”

The mean creativity percentages appear to affirm the assumption that the observation or scrutiny time of the student at the beginning is important for the following stages of the creative process, thus resulting in creative scores. The student who has received the lowest mean creativity score has not spent much time (10 minutes) for observation of the task and imagery of what she wants to do, and the student who has received the highest score has spent a considerable amount of time (35 minutes) for the same activity. Observation time and total creativity were found to be highly correlated [correlation coefficient=0.624]. (see Table 4.8). The results of the elements of creativity have been considered as having equal weight and been standardized to achieve a total mean of 100%.

Table 4.8. The Mean Scores in Percentages for Each Student Related to the Association Between the ‘Elements of Creativity and Observation Time at the Beginning of the Task’

Subjects	Observation Time at the Beginning (minutes)	Elements of Creativity (%)			Mean (%)
		Person	Process	Product	
1	10	5.62	5.79	6.66	18.07
2	45	17.54	16.39	18.47	52.40
3	20	5.31	8.80	25.71	39.82
4	35	18.63	11.02	24.42	54.07
5	35	18.53	21.56	13.71	53.80
6	20	9.20	4.76	6.66	20.62
7	20	21.86	19.04	6.66	47.56
8	10	7.02	1.90	7.05	15.97
9	15	16.85	1.90	9.33	28.08
10	20	20.89	20.33	12.76	53.98
11	30	13.13	4.76	9.33	27.22
12	15	12.34	17.58	18.66	48.58
13	15	16.75	5.39	6.66	28.80
14	15	16.58	13.33	6.85	36.76
15	20	15.03	11.90	13.71	40.64

(Note: Two decimals have been furthered in each percentage. The internal validities of the observational features were controlled by Alpha Cronbach tests, and the only the validities over 0.8 were taken into consideration.)

4.8.4 ‘Assessment of the Projects’

Most students thought that their studio-work deserved a higher grade than what they believed the instructors would give them (see questions 12 and 13 in Appendix D). The responses to the questions on how the students would grade their own work and how they thought the instructors would grade them, were almost unanimously concentrated around ‘C’ (with the exception of one student who gave a B-, and another who gave a D+ for both answers) with their grade usually being higher than the instructors’. Common answers regarding the deserved and expected grades stated by the students were,

'C+ and C', 'C+ and C-', and 'C+ and C+' respectively. None of the students believed that they were able to reflect their best performance on paper and believed that they should have more time for all projects, however, the instructors stated that there is never sufficient time according to the students as they adjust the project solution process according to the allotted time.

The 'instructors' grades' and the 'students' expected grades' were found to be significantly different [$t=4.63$, $df=14$, $p\leq 0.00$]. Most students believed that they should receive higher grades than what they generally get from their instructors. According to one student this was generally the case:

“Sometimes I don’t deserve to get a higher grade,
but I think I usually I do deserve it.”

The difference between the 'instructors' grades' and what the students actually believed that they 'deserved' approved this [$t=4.63$, $df=14$, $p\leq 0.00$]. Moreover, the relation between the 'students' expected' and the 'students' 'deserved' grades was in line with this finding [$t=15.02$, $df=14$, $p\leq 0.00$], and they were found to be highly correlated [correlation coefficient=0.791].

4.8.5 'Context/ Environment'

A common response from the students to the question of the environmental features that would make the students work more efficiently and creatively, was, that it should be a more flexible environment on various levels. They believed that first, constraints related to time, due dates, and grades should be minimized. In addition, noise inside the studio has been mentioned a number of times as a factor that negatively influenced the design process:

“Sometimes it gets so noisy, I can’t think about anything. I can usually concentrate better at home.”

The students also mentioned a wish for inspiring posters, projects, pictures, and models on the walls and in the studio environment. One student also indicated that, it would be nice to have a comfortable space within the studio with collection of design books and magazines that would help the students in their projects.

“A cozy corner with cushions and a library of books, magazines, and idea sources would be great!”

A calmer, cleaner, quieter environment that was comfortable was what seemed to be suitable according to the students’ needs. This discovery is consistent with the findings in countless research on the character and quality of the environment creativity is most likely to flourish (Kristensen, 2004).

4.8.6 ‘Curriculum’

Similar to the case in the pilot study, most students emphasized the importance of the process as well as the product:

“Sometimes I work for days, take regular critiques, do research, but still nothing comes up. I think this effort should be taken into consideration.”

They stated that the emphasis is placed on the product and their efforts are not recognized if they cannot produce a successful product. Moreover, the

research that they do are not taken into consideration according to four of the students. However, the students may not be able to make use of the research that they carry out by representing the findings and inspiration sources on their projects, or not be able to express –visually or verbally- how they plan to use this new information. Both situations identify a lack of communication that has to be resolved in order to gain progress throughout the semester. Thus, it appears that the sketching technique and research necessitate improvement.

The students also stated that the stress of grades was a factor that negatively influenced their performance, and that the fear of grades and instructors restricted their creativity:

“How can I be creative when I’m constantly thinking about whether I’ll pass or not? Especially towards the end of the semester, I’m constantly uneasy. This reflects on my performance in general as well as in the studio.”

Generally, the students with higher CGPA’s (and university exam scores) seemed to be more confident about themselves and did not mention a fear of grades.

The correlation between university entrance exam scores and the CGPA’s of the students was analyzed, and it was found that, they were highly correlated [correlation coefficient=0.835]. Moreover, total creativity and task grade was found to be highly correlated [correlation coefficient=0.746]. However, the students’ creativity levels may not have a linear relationship with neither CGPA or the university entrance exam scores. It is possible that the creativity

scores regarding the person, process, and product may not be related with the scores of the university exam that assesses the correct answering of questions according to previously learned material. The same is true for the CGPA that is a total score derived from a number of various classes that the student has taken. Although there was a high correlation between the university entrance exam scores and the CGPA's, they had no relationship with the students' creativity levels. There was no significant correlation between total creativity and the university entrance exam score [correlation coefficient=0.100]. The same can be stated for the relationship between total creativity and CGPA [correlation coefficient=0.431].

4.9 Discussion

In this section, the findings of the study will be discussed according to the initial assumptions, and the related statistical references will be given.

- 'There is a relationship between the type and quantity of representation, and creativity':

Three-dimensional representations such as, perspectives and models were found to lead to higher creativity levels compared to two-dimensional depictions such as, layouts/ plans. Cross-sections were nevertheless mentioned, as they enable to see various features inside the space on different levels. Thus, more importance should be given to sketching, so that this significant skill of designers can fully develop in a way that enables the students to easily represent what they visualize in their minds. The skill of visualizing and representing the visualized necessitates more attention and

exercise on the part of the students. Finally, while verbalization during the design process and among classmates can be constructive, as also supported by Eastman et al. (2001), excessive reliance on verbalization in critiques appears to weaken the skill of sketching.

- 'The creative quality/ characteristic of the decisions made can be increased by way of first understanding the creative process that involves cognitive components':

Putting the creative process under the microscope was helpful in understanding preferred imagery and representation styles and quantity, time spent at different stages of the process, underdeveloped skills, behavior, in addition to student-student and student-instructor relations, and associations between creative processes and products. Understanding these relations can be helpful in developing the curriculum to aid the skills necessary to experience more creative processes conducive to produce more creative products in the design studio. The results can then be extended into practice.

- 'There is a relationship between the observed creative traits and product creativity':

This relationship can easily be seen in the observations. Those students who did not only work on their projects, but also spent time on asking others' opinions and discussing their projects were among the most creative ones. This, of course, should not be confused with mingling with everyone in the studio and killing time. A constructive interaction between the students was observed to be helpful in developing their ideas. During these exchanges of

ideas, they have the opportunity of noticing something they had not noticed before, see different ways of looking at the problem, or develop an existing idea. Even visual contact has been observed to be useful. That is, seeing another student working and seeing what s/he is doing was observed to motivate the students and keep up with the same phase. The students in each group completed the phases with similar timing and submitted the project almost simultaneously. Thus, the three groups were consistent within themselves in terms of timing although most seemed to prefer being alone for the first creative idea. The arrangement of the studio environment affected the behavior of the students, and three students mentioned becoming more motivated while working individually in a group arrangement of tables. Simonton (2003) agrees that working within a larger group of people on different levels enables the interaction of creative ideas as a result of being subject to the work of classmates and predecessors of the field.

- 'There is a relationship between imagery and representation amounts and creativity':

This assumption appears verified, in that, the students who have used more imagery were more creative [$\chi^2=24.75$, $df=15$, $p\leq 0.05$]. Two of the most creative students used more than 70% imagery (highest percentage), and one of the least creative students used less than 30% imagery (lowest percentage). The relationship between creativity and imagery use seems to be not significantly independent (7 students stated that they used 70% imagery and 30% representation). Total creativity and imagery use were found to be highly correlated [correlation coefficient=0.623]. Total creativity of

the product and imagery use in a project were also found to be highly correlated [correlation coefficient=0.584].

Since imagery was generally used in the beginning phases, it can be stated that the initial ideas and concepts were found mostly by this technique.

However, imagery alone cannot be sufficient to improve an idea, and good representational skills are crucial in the development phases.

The students who made use of their readiness stage by utilizing imagery were found to be the more creative ones. However, these students were also the ones who actually did use this time to their advantage instead of wasting their time walking around the studio or as an extended 'pre-readiness' stage in which the students prepare the equipment that they plan to use during the process. This results in an ineffective use of time and necessitates the students to jump from the 'pre-readiness' stage to the reception stage without fully living the previous. The students who skip this stage, also miss out on certain important uses of this stage, such as, visualizing the space they will be creating in their minds.

- 'A deliberately applied user-identification stage may improve the quality of design products':

This in turn, may broaden designers' perspectives, and thus enhance creativity. Although this technique has not been tried in the application, the students who were found to be more creative in their products by the instructors, mentioned that they visualized the space by identifying with user

or customer, and stated that this is the way they think when they are first introduced to a project. Both 'visualization' and 'identification' processes seem to have had useful outcomes in terms of creativity.

5. CONCLUSION

In this final chapter, a summary of the findings are given, followed by a discussion on means to adapt and utilize the proposed model in various circumstances.

5.1 Summary of the Findings

Apart from the assumptions-related findings mentioned in the previous section, the repeating themes in this investigation can be summarized as follows:

General Profile of the Students:

- The grades of the students regarding the design studio showed little difference throughout the semesters.
- The university entrance exam results and CGPA's were found related.
- Creativity and university entrance exam results were not significantly related.
- Creativity and CGPA's were not significantly related.

Creative Person:

- Under 'Creative Person', the students were found creative in the 'completion' and 'control' items.
- 'Sensitivity' was an item in which all students were found to be either 100% creative or none at all.

- Most students were found to be calm, balanced, and in charge, with a high level of 'control'.
- 'Humor' was found to be a mostly male characteristic.

Creative Process:

- Under 'Creative Process', due to the lack of being able to find new ways of solving problems and too much reliance on critiques and observer's opinions, there is need for more attention in the 'originality' item.
- Most students were found to be reluctant in the need to meet challenge and attempting difficult tasks, thus were lacking in 'self-courage'. More attention is believed to be necessary in this category.
- The students were found to be non-creative in the 'negativity' item, and high in 'control', which are believed to be related to one another, as the students controlled their actions and did not show much negative behavior. Nevertheless, it was interesting that they were comfortable about 'movement' within the studio environment.
- Regarding 'identification', the students were either fully creative, or fully non-creative.
- Total creativity of the process and of the person were found to be highly correlated [correlation coefficient=0.606].

The 5R's:

- Under the 5R's, the most time spent was in the 'reception' stage.
- Very little time was spent on the final stage of 'recreation', which prevented most students from finalizing their tasks and preparing them for assessment.
- The students who spent the most time in the final stages came closer to finishing their tasks.
- Time spent in the 'readiness' stage and product creativity appear to have a linear relationship.
- How quality of time is utilized in each stage is as important as the quantity of time spared for each stage.

Creative Product:

- Under 'Creative Product', the results of the students in the items within this category appear related.
- The students like dealing with furniture and details but more attention is necessary regarding light, material, value, and color.
- 'Ability to answer deficiencies', 'line', and 'repetition' were the items, and 'product creativity' was the category in which students scored the highest.
- Total creativity and total creativity of the product were found to be highly correlated [correlation coefficient=0.672].

Retrospective Interviews:

- In the 'Retrospective Interviews', it was found that there was a lack of effective communication between the instructors and the students, and this was mostly dependent on the reliance of the students on verbal communication and negligence of interactive sketching.
- Although the students stated they utilized color as a useful method of imagining ideas and solving problems, the instructors did not think that this skill had developed fully and used effectively. More attention is believed to be necessary at this point, as color is one of the most significant tools of a designer. The reason for this may also be due to leaving color to the end stages and then not having enough time to deal with it successfully at the end of the task period (as mentioned before, the final stage of 'recreation' is one in which very little time is spent).
- The fear of grades is widespread among students and appears to influence their performance and actions.
- A time constraint appears to be significant for creativity, and creativity seems to peak at the final stages of the design process.
- Reflecting the concept to the project appears to take the most time.
- Time spent observing the task or project at the beginning of the creative process influences the total creativity.
- The students suggest more emphasis to be given to the creative process.
- The students believe that they are not assessed fully, and thus, receive lower grades than they deserve.

- Self-courage, university entrance exam scores, and CGPA's appear to be related, in that, the students scoring higher in the exam and in their standing are more confident about themselves.
- For a studio environment that will make them more creative and efficient, students suggest an environment without constraints and interruptions, more time, less pressure, more inspirational ideas being discussed in the studio, being exposed to more sources of inspiration in general and within the studio (inspiring posters, projects, pictures, and models, television, design magazines, books), and a warmer atmosphere in general.

Keeping the goals of the task explicit from the very beginning, helping students become aware of their own creative problem-solving methods, effective time-use, a short series of imagery exercises to help students come up with a concept, elaborate on it, and visualize the space before beginning to work on the layout, and encouraging students to identify with the users may be useful techniques to support the creative process. Furthermore, group-work, inspiring students to personalize their studios, and making them aware of criticism techniques about both their own work and their classmates may be additional measures to enrich the creative process and the products that come out as a result of that. All the reference points stated above can be used to further the study, as well as for design criteria to consider within the studio environment.

5.2 Finalized Version of the Model

The model proposed in this study is open to improvement and adjustment according to the particulars of any other research study (see Figure 5.1). Among limitations of the study, the size of the sample, and the time being constrained to a day may be considered. Therefore, further implications of the study may be to work with a larger sample group. The investigation may be further carried on to analyzing comparisons between sample groups of different education levels and fields. With regards to time, previously designated time periods may be given to the subjects, and follow-up studies may be made regarding the creativity of the subjects during various levels of their education.

Apart from the issues mentioned above, the model can be adapted to different situations considering a number of topics. These can be collected under four major headings -namely, 'space', 'field', 'age', and 'time'.

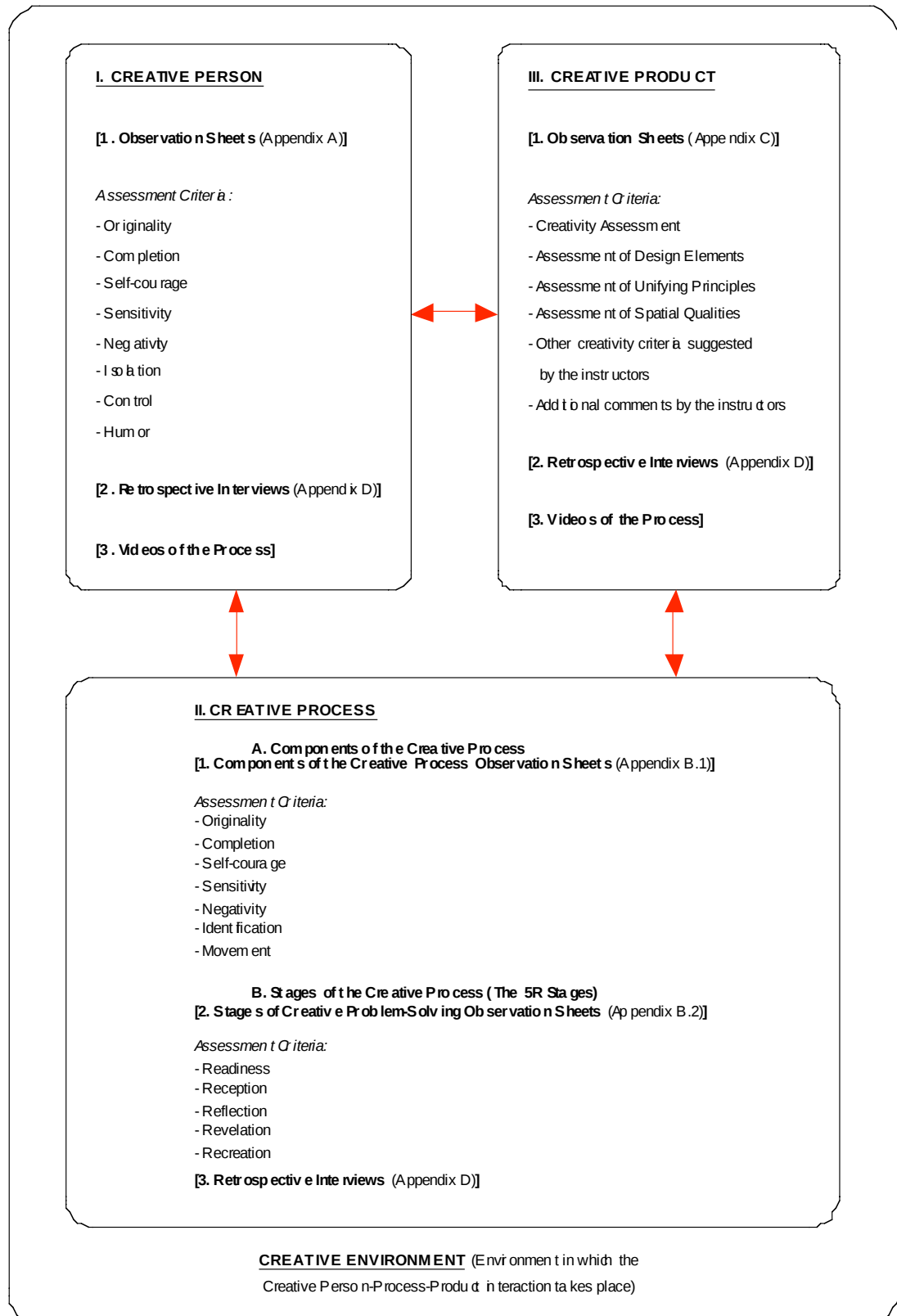


Figure 5.1. Applied Model of the Creative Process

First, the aspect of 'space' may be a variable that has to be taken into consideration. In this study, the creative process takes place within a certain social and physical environment. It is not possible to say that the environment plays no part as the shell in which everything takes place. The interaction of the creative person, process, and product happens within a complete system of which the environment is an essential part. Aspects related to culture, social relations (student-student and student-instructor), and unique dynamics of the field of design have to be taken into account.

This leads us to the issue of the 'field'. Design is a very distinctive field. Although creativity is a topic that can be discussed in any field, the issues that will be looked for in each field will unavoidably be different. Thus, the elements and characteristics sought by the instruments used to assess the creative person, process, and product will be different due to differences of the expected natures of these elements in each field. Special characteristics unique to the field to define these elements will have to be collected and tested before application on the sample group. Even within the general title of "design", the expected features regarding the creative person, process, and product will be different in different scales and areas of design such as, industrial design, interior architecture, architecture, landscape, and city planning.

'Age' is another issue to be considered while applying this model. There was a particular reason behind the choice of age group in this study explained within the theoretical framework. If the model is to be applied to students in

another age group, their level of development, knowledge, and experience, have to be considered. If the age does not coincide with the peak point of creativity, other ways of extracting or tracking creativity must be appropriated within the study. Moreover, if the model is to be applied to graduated and practicing persons, features regarding the company and nature of the work, schedule, social composition and the like need to be taken into account.

The final aspect to be thought of is 'time'. Time, here, is accepted to be the duration of the application. Studies planned to take a shorter or a longer amount of time will necessarily have different expectations from the students in terms of creativity and the operation of the process. In a study with a shorter duration, for instance, the 5R's will most probably take place much more quickly, somewhat blending into one another. One that takes a longer amount of time, on the other hand, will expect much more refined task results from the students, and other features such as, effects of working at home or internet access. In a situation as such, it will be difficult to isolate the student's own creativity, thus, other ways should be investigated to control features regarding the particulars of the creative person, process, and the product. Having considered the aforementioned issues, using the same general framework, but replacing the particulars, however, the model will most likely be applicable to other situations, ages, and fields as well.

This study analyzes the relationship between creativity and cognition in a comprehensive manner. The aim is to improve creativity in the design studio for its own sake as well as for effects that extend to the professional life of

designers. By understanding the cognitive process of the creative experience, a model is proposed, first to understand the process itself, and then to reflect it upon the curriculum of design institutions.

This model can then be utilized for creating an atmosphere that students can work in a way to enhance creative potential, bring about suggestions for curriculum changes, and improve designs of the students both in the studio and after graduation.

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APPENDICES

APPENDIX A: CREATIVE PERSON, PROCESS, AND PRODUCT ASSESSMENT SHEETS

(Done by the Observer)

Name:
Age:
Sex:
Grade:

CREATIVE PERSON ASSESSMENT SHEET

1. ORIGINALITY

CREATIVE – NON-CREATIVE

unconventional	-	conventional
having wild, silly, extraordinary ideas	-	having down to earth, ordinary ideas
radical	-	not radical
scrambled mind	-	organized, common thinking
complex	-	simple
can easily fashion products	-	can not easily fashion products
flexible	-	inflexible
can abstract a given problem	-	can not abstract a given problem

2. COMPLETION

CREATIVE – NON-CREATIVE

gets to work quickly	-	spends time before getting to work
will work until the completion of work	-	will not work until the completion of work
energetic, enthusiastic about work	-	not energetic, enthusiastic about work
does not mingle with others	-	mingles with the whole class
fluent	-	not fluent
elaborating	-	non-elaborating

3. SELF – COURAGE

CREATIVE – NON-CREATIVE

open	-	reserved
autonomous	-	dependent
non conforming	-	conforming
self sufficient	-	not self sufficient
self accepting	-	self refusing
egocentric	-	not egocentric
egotistic	-	not egotistic
secure	-	insecure
emotionally mature	-	emotionally immature
able to cope with distress	-	can not cope with distress
self-centered	-	not self-centered
does not ask for help	-	asks for help
internally oriented	-	externally oriented
willing to take risks	-	not willing to take risks
adventurous	-	not adventurous
hopeful with complex tasks	-	panics with complex tasks
not bound to habits	-	Is reluctant in leaving habits

4. SENSITIVITY

CREATIVE – NON-CREATIVE

socially sensitive	-	socially ignorant
emotionally sensitive	-	emotionally ignorant
perceptive	-	not perceptive
curious	-	not curious
intuitive	-	not intuitive

5. NEGATIVITY

CREATIVE – NON-CREATIVE

inconsiderate of others	-	considerate of others
oppositional	-	accepting
annoying	-	calm
offensive	-	polite
not one of the best students	-	one of the best students

6. ISOLATION

CREATIVE – NON-CREATIVE

isolated	-	not isolated
withdrawn	-	extrovert
sociable	-	not sociable
estranged	-	not estranged
independent of judgment	-	dependent on judgment
uncooperative	-	cooperative

7. CONTROL

CREATIVE – NON-CREATIVE

non defensive	-	defensive
stable	-	unstable
controlled	-	not controlled
realistic	-	not realistic

8. HUMOR

CREATIVE – NON-CREATIVE

humorous	-	not humorous
child-like, playful	-	not playful
toys with, and makes use of the environment	-	is ignorant of the environment

Appendix B. CREATIVE PROCESS ASSESSMENT SHEET

Appendix B.1 Components of the Creative Process Observation Sheets

(Done by the Observer)

1. ORIGINALITY

CREATIVE – NON-CREATIVE

finds different ways of solving problems	-	prefers conventional solutions
adopts new perspectives	-	does not search for new perspectives
makes good use of material at hand	-	does not make good use of material at hand
invents new tools and media	-	does not think of inventing new tools and media
not subject to group standards and control	-	subject to group standards and control
does not follow models and examples	-	follows models and examples
perfects a skill by copying	-	does not need to perfect skills
needs to be different	-	does not need to be different
easily defines problems	-	can not easily define problems
thinks outside normal boundaries	-	has common, conventional way of thinking

2. COMPLETION

CREATIVE – NON-CREATIVE

engaged in task and motivated	-	distracted, not motivated
involved completely in the task, becomes ignorant of the environment	-	is not involved in the task
attached to the environment s/he works in	-	is not attached to the environment he works in
diminishing interest in other people and what they may be doing	-	interested in other people and what they may be doing
does not look around for inspiration	-	looks around for ideas
works without interruption until finalization	-	may be distracted

3. SELF-COURAGE

CREATIVE – NON-CREATIVE

responds constructively to new situations	-	adapts, adjusts to existing situations
can easily transfer life experiences to symbolic or pictorial representations	-	can not easily transfer life experiences to symbolic or pictorial representations
needs to meet challenge	-	does not search for challenge
attempts difficult tasks	-	does not attempt difficult tasks
independent in choices	-	dependent in choices
courageous in convictions	-	not courageous in convictions
open to experience	-	reluctant about experience

4. SENSITIVITY

CREATIVE – NON-CREATIVE

reacts to experience fully in thought and feeling	-	does not react to experience fully
asks questions on seemingly insignificant parts of the experience	-	does not ask many questions
shows increasing awareness while working	-	does not show increasing awareness
needs flexibility in the environment	-	does not need flexibility in the environment

5. NEGATIVITY

CREATIVE – NON-CREATIVE

frequently punished, not approved by teachers	-	calm, liked by teachers
indifferent to conventions and courtesies	-	cares about conventions and courtesies
challenges rules and authority	-	obeys rules and authority
rebellious, uncooperative	-	cooperative
capricious, careless, disorderly	-	careful, orderly
absentminded, forgetful	-	careful about duties
argumentative, cynical, sarcastic	-	accepting, obeying
sloppy with details	-	careful with details
temperamental while dealing with a task	-	calm while dealing with a task
overactive physically and mentally	-	calm physically and mentally

6. IDENTIFICATION

CREATIVE – NON-CREATIVE

identifies with task	-	does not identify with task
directly or indirectly includes her/himself in work	-	does not include her/himself in the project

7. MOVEMENT

CREATIVE – NON-CREATIVE

at ease	-	nervous
flexible	-	inflexible
comfortable body gestures	-	rigid body gestures
shows kinaesthetic experiences	-	does not show kinaesthetic experiences
likes movement while dealing with task	-	does not like movement while dealing with task

Appendix B.2 Stages of Creative Problem-Solving (5 R's) Observation Sheets

1. READINESS: (Purposeful Intention)

Time: (min.)

on time	-	not on time
eager to begin	-	not eager to begin
motivated	-	not motivated
quickly gets ready	-	takes his/her time in getting ready
quickly prepares equipment	-	takes his/her time in preparing equipment
aware of thoughts/ boundaries	-	unaware of thoughts/ boundaries

2. RECEPTION: (Receptive Awareness: Representation)

Time: (min.)

high tolerance for ambiguity	-	low tolerance for ambiguity
low need for boundaries	-	high need for boundaries
non-judgmental	-	judgmental
observes intently with all senses	-	does not observe intently with all senses
all information received is included	-	not all information received is included
shows sensitivity towards the environment	-	does not show sensitivity towards the environment
understands the task	-	does not understand the task
begins the interpretation of the task	-	does not begin the interpretation of the task
clarifies the task in his/ her mind	-	task is vague in his/ her mind
selects an initial idea	-	cannot select an initial idea
uses tools such as drawing or sketching to develop the idea	-	does not use any tools

3. REFLECTION: (Reflective Attention: Adding on)

Time: (min.)

high need for boundaries	-	low need for boundaries
integrates new information with established thought patterns	-	does not integrate new information with established thought patterns
interactive regarding the thought pattern	-	not interactive regarding the thought pattern
collaborative regarding the thought pattern	-	not collaborative regarding the thought pattern
pays careful attention to the information received	-	does not pay careful attention to the information received
reflects on new and old ideas	-	does not reflect on new and old ideas
externalizes ideas	-	does not externalize ideas
transforms of the idea from conceptual to physical	-	does not transform of the idea from conceptual to physical
uses previous knowledge	-	does not use previous knowledge
remembers/ associates previous activities	-	does not associate previous activities
uses expertise	-	does not use expertise
structures/ restructures, extends ideas	-	does not structure/ restructure, extend ideas
decides on ideas to explore and abandon	-	does not decide on ideas to explore and abandon

4. REVELATION: (Emergent Pattern: Integration)

Time: (min.)

low tolerance for ambiguity	-	high tolerance for ambiguity
low need for boundaries	-	high need for boundaries
fluid pattern definition occurs	-	fluid pattern definition does not occur
nurtures initial results of process	-	does not nurture initial results of the process
recognizes the initial pattern that has emerged	-	does not recognize the initial pattern that has emerged
the solution takes on physical entity	-	the solution does not take on physical entity
the solution undergoes physical constraints	-	the solution does not undergo physical constraints
physical structure influences outcome	-	physical structure does not influence outcome
imagery occurs	-	imagery does not occur
representation occurs	-	representation does not occur

5. RECREATION: (Expression/ Manifestation: Drawings, Model)**Time: (min.)**

low tolerance for ambiguity	-	high tolerance for ambiguity
high need for boundaries	-	low need for boundaries
gives expression to experience	-	does not give expression to experience
integrates task and reality	-	does not integrate task and reality
manifestation of form	-	no manifestation of form
assesses the form	-	does not assess the form
the ideas are resolved	-	the ideas are not resolved
useless ideas are abandoned	-	equivalent ideas still linger
details are finalized	-	details are not finalized
representations are perfected	-	representations cannot be perfected
the task is controlled for missing points	-	the task is not controlled for missing points
the task is prepared for exhibition, assessment, or jury	-	the task is not prepared for exhibition, assessment, or jury

APPENDIX C: CREATIVE PRODUCT ASSESSMENT SHEET

(Done by the Observer and Instructors)

CREATIVITY ASSESSMENT

	poor	average			excellent
1. Value	1__	2__	3__	4__	5__
2. Appropriateness	1__	2__	3__	4__	5__
3. Flexibility	1__	2__	3__	4__	5__
4. Fluency	1__	2__	3__	4__	5__
5. Novelty	1__	2__	3__	4__	5__
6. Originality	1__	2__	3__	4__	5__
7. Elaboration	1__	2__	3__	4__	5__
8. Ability to answer needs	1__	2__	3__	4__	5__
9. Redefinition	1__	2__	3__	4__	5__
10. Open-endedness (Evolution)	1__	2__	3__	4__	5__

ASSESSMENT OF DESIGN ELEMENTS

	poor	average			excellent
1. Line	1__	2__	3__	4__	5__
2. Shape and Form	1__	2__	3__	4__	5__
3. Space	1__	2__	3__	4__	5__
4. Texture	1__	2__	3__	4__	5__
5. Value	1__	2__	3__	4__	5__
6. Color	1__	2__	3__	4__	5__
7. Light	1__	2__	3__	4__	5__

ASSESSMENT OF UNIFYING PRINCIPLES

	poor	average			excellent
1. Repetition	1__	2__	3__	4__	5__
2. Variety	1__	2__	3__	4__	5__
3. Rhythm	1__	2__	3__	4__	5__
4. Balance	1__	2__	3__	4__	5__
5. Emphasis	1__	2__	3__	4__	5__
6. Unity	1__	2__	3__	4__	5__
7. Harmony	1__	2__	3__	4__	5__

ASSESSMENT OF SPATIAL QUALITIES (APPROPRIATENESS, PRECISION)

	poor	average			excellent
1. Concept execution	1__	2__	3__	4__	5__
2. Atmosphere/ ambiance (material, color, texture, and lighting)	1__	2__	3__	4__	5__
3. Planning/ Layout	1__	2__	3__	4__	5__
4. Building system and components (HVAC, sound systems)	1__	2__	3__	4__	5__
5. Ergonomics (health, safety, comfort)	1__	2__	3__	4__	5__
6. Use of Standards	1__	2__	3__	4__	5__
7. Furniture (choice, design, utilization)	1__	2__	3__	4__	5__
8. Design details	1__	2__	3__	4__	5__
9. Material use	1__	2__	3__	4__	5__
10. Presentation	1__	2__	3__	4__	5__
11. Craftsmanship	1__	2__	3__	4__	5__

DESIGN GRADE OF THE STUDENT

OTHER CREATIVITY CRITERIA SUGGESTED BY THE INSTRUCTORS

ADDITIONAL COMMENTS BY THE INSTRUCTORS

CREATIVITY ASSESSMENT

1. **Value:** The project having value in the context it is assessed in (value for the society).
2. **Appropriateness:** While “value” includes certain external standards that may not be directly related to the problem, “appropriateness” involves the extent to which the solution content of the problem answers the needs of the design problem in terms of function and aesthetics (appropriateness, suitability of the solution to the problem).
3. **Flexibility:** The project being responsive to change and adaptable if situation arises.
4. **Fluency:** The project solution being quick, smooth, and natural (as opposed to difficult and painful).
5. **Novelty:** The quality of something being new and unusual for the student and level of education.
6. **Originality:** Having fresh, authentic, and unusual ideas in the project that precede others' ideas, projects, and known designs.
7. **Elaboration:** Intricate and rich project that is planned or executed with attention to detail.
8. **Ability to answer needs:** The quality of the project to answer the needs of the problem in terms of timing and general quality.
9. **Redefinition:** The reinterpretation of the given problem in an original way.
10. **Open-endedness (Evolution):** The quality of the project not being limited, showing progress in time and evolving creatively.

ASSESSMENT OF DESIGN ELEMENTS

1. **Line:** The quality, character, and use of lines in the project.
2. **Shape and Form:** The use 2D and 3D geometric shapes in the project.
3. **Space:** The use of spatial aspects in the project.
4. **Texture:** The use of different appearances and textures on surfaces in the project.
5. **Value:** The use of relative darkness or lightness of colors in the project.
6. **Color:** The use of colors in the project.
7. **Light:** The use of lighting and awareness of its effects on the atmosphere of the project.

ASSESSMENT OF UNIFYING PRINCIPLES

1. **Repetition:** The use of repeating elements in order to convey particular design decisions.
2. **Variety:** The use of various design elements in order to depict effects, such as surprise.
3. **Rhythm:** The use of alternating patterns and regular recurrence of design features to convey familiarity.
4. **Balance:** A harmonious arrangement or proportion of parts of the project.
5. **Emphasis:** Use of special techniques to single out or accentuate certain features of the project.
6. **Unity:** Functional continuity among the parts of the project.
7. **Harmony:** An aesthetic and pleasing combination of elements in the project.

ASSESSMENT OF SPATIAL QUALITIES (APPROPRIATENESS)

1. **Concept execution:** Success in applying the concept to the 3D space (An elusive idea to space).
2. **Atmosphere/ ambiance:** (by material, color, texture, and lighting)
3. **Planning/ Layout:** Success in planning the layout and organization of the design.
4. **Building system and components:** (HVAC, sound systems)
5. **Ergonomics:** (health, safety, comfort)
6. **Use of Standards:**
7. **Furniture:** (choice, design, utilization): Success in choice or design of furniture within the project space.
8. **Design details:** Success in application of design details.
9. **Material use:** Success in choice and use of material in the project.
10. **Presentation:** Success in the use of presentation techniques.
11. **Craftsmanship:** Skill in preparation of drawings and models.

The criteria for the assessment of the product were derived from the curriculum of the third year design studio, and are the general measures that a design project is assessed according to. Additional to these features, certain criteria were also believed to be important and therefore added to the assessment sheet. Dorst and Cross (2001) stress the importance of “ergonomics”; Purcell and Gero (1998) state the importance of “material”, “texture”, “color” that form the atmosphere of the space (lighting is also an essential part of the atmosphere, so that was included as well, in addition to “conceptual knowledge”, “structure”, “manufacture”, “construction”; and Christiaans (2002) signifies the importance of “workmanship” or craftsmanship.

1. Concept execution
2. Atmosphere/ ambiance (by material, color, texture, and lighting)
3. Planning/ Layout
4. Building system and components
5. Ergonomics (health, safety, comfort)
- 6 Use of Standards
7. Furniture (choice, design, utilization)
8. Design details
9. Material use
10. Presentation
11. Craftsmanship

APPENDIX D: RETROSPECTIVE INTERVIEW SHEET (open-ended)

(Done by the Observer)

Investigator:

- * Ask and explain each question if necessary.
- * Explain what is meant by "representation", and "imagery" (designing in the mind).
- * Describe "character".
- * Describe "creative".
- * Be open to and note other information -such as facial expressions- sent out by the student.

Name:

Sex:

Date:

1. If you were to quantify (in percentages) the "amount" of design you thought of in your head and the amount you represented, what would the distribution be like?

(To understand the difference in quantity between imagery and representation)

- a.** 30% in my mind - 70% represented
- b.** 50% in my mind - 50% represented
- c.** 70% in my mind - 30% represented
- d.** less than 30% in my mind - more than 70% represented
- e.** more than 70% in my mind - less than 30% represented

2. Describe the "character" of thoughts/ visualizations you had in your mind before you began your representations.

(To understand the nature of imagery and see if there are any commonalities between students)

3. Describe what caught your attention the most and what you emphasized in your solution.

(To understand the nature of prominent inspiration sources, if there are any)

4. In the beginning of a project, do you always represent your thoughts in the same way?

(To see if students change their representation techniques or follow the same ones, and see if there are any commonalities between students)

5. What kind of representation do you like the most?

(To understand the nature of representation techniques students feel close to and easy to use)

6. What is the first thing that caught your attention/ inspired you in this project?

(To see if there is a consistency in the answers of the students. If so, significant features can be emphasized in projects)

7. Describe the turning point/ milestone of every major decision that you made.

(To see if there was a consistency in the significant changes of direction)

8. Describe your most creative thought or decision in your solution to the project.
(To compare students', instructors', and observer's views on creativity)

9. At which stage(s) do you think you were the most creative?
(To understand the relation between the stages and believed creativity. Also, to compare the responses of the students, instructors, and observer)

10. At which stage(s) do you think you spent the most time? Why?
(To see the relation between creativity and time. Also, to observe any differences between real time and perceived time)

11. State everything that would make you work more
a. efficiently.
b. creatively.

(To see students' suggestions on what could be done about producing creative works efficiently)

12. State how you would grade your own work, with reasons for your decision.
(To see how the students would rate their work, and what they believe they should get credit for. Also, to compare students' and instructors' responses)

13. State your expected grade for this task, with reasons for your decision.
(To see how students rate their work in the eyes of their instructors, and their reasons for it. Also, to compare students' and instructors' responses)

APPENDIX E: BEHAVIOR OF THE STUDENTS

This section concentrates on the background of each individual student, by analyzing their *gender*, which *city* they are from (from a larger or smaller city), their *high school education* (public or private), their *university entrance exam score*, their *CGPA's* in this department, and their *Design studio grades*.

Student 1

Student 1 is male, and from Ankara. He has graduated from the private high school of TED Ankara Koleji Vakfi Ozel Lisesi, and his university entrance exam score is 124.02. His CGPA is 1.6 for the time being, and his Design studio grades from his first year to this day are as follows: F (which he repeated and received a D+), C, C-, and D+.

According to his instructors, this student is an inattentive student who does not concern himself with deadlines, requirements, and schedules. He can be forgetful and sloppy, and likes to mingle with the class. Although he spent most of his time that day at his desk trying to solve the problem, he took frequent breaks signaling that he did not have much time to concentrate on the task and use imagery or visualization techniques.

Student 2

Student 2 is male, and from Eregli. He has graduated from the public high school of Zonguldak Eregli Anadolu Lisesi, and his university entrance exam score is 166.208. His CGPA is 2.94 for the time being, and his Design studio grades from his first year to this day are as follows: B-, C+, B, and C+.

This student is one who is known for taking his time in everything he does, but still tries to meet the deadlines. The day of the application, he listened to the requirements attentively, and used a great deal of imagery. After preparing his tools, markers, and paper, he sat without doing anything for about twenty minutes. He did not talk to anyone during this time and did not look around much, but looked up at the ceiling. After this period, he began the task hurriedly and occasionally stopped to look back at the ceiling or talk to his classmates. He was the last to submit his paper at the end of the day.

Student 3

Student 3 is female, and from Ankara. She has graduated from the public high school of Cankaya Ataturk Lisesi, and her university entrance exam score is 149.358. Her CGPA is 2.21 for the time being, and her Design studio grades from his first year to this day are as follows: C-, D+, D+, D+, followed by the repetition of her last year involving the last two grades, and replacing the D+'s with C- and C, respectively.

This student mingled with the whole class the whole day, and used up most of her time in conversation. However, she also talked to her friends about her project and tried to finish her perspective very quickly. She was having trouble using her time effectively throughout the day. She did not use imagery much, but almost directly began drawing and tried to figure out details as she went along.

Student 4

Student 4 is female, and from Izmir. She has graduated from the private school of Ozel Izmir Amerikan Lisesi, and her university entrance exam score is 180.652. Her CGPA is 2.93 for the time being, and her Design studio grades from his first year to this day are as follows: C-, C-, B-, and B.

This student was very careful with the details of the project and tried to find out the most she could about the requirements. She talked to her instructors more than her friends, but also conversed with classmates on her project. She was confident and seemed to know what she wanted to do from the beginning. She used imagery at the very beginning when she sat and looked ahead for a while. She then began her project quickly and occasionally stopped for more visualization.

Student 5

Student 5 is female, and from Ankara. She has graduated from the private high school of Ozel Yuce Fen Lisesi, and her university entrance exam score is 175.628. Her CGPA is 2.82 for the time being, and her Design studio grades from his first year to this day are as follows: B, B, B-, and C.

This student was also one that was very confident in herself and her project. She sat with her head in her hands periodically, then quickly went to work. She repeated this sequence throughout the day, sometimes also involving in humorous conversations when she took short breaks. She was one of the students who used her time very effectively and came very close to the completion of the task.

Student 6

Student 6 is female, and from Ankara. She has graduated from the private high school of Ozel Aykan Lisesi, and her university entrance exam score is 168.578. Her CGPA is 2.22 for the time being, and her Design studio grades from his first year to this day are as follows: F (which was repeated and replaced by a B), C+, D, and C.

This student is a rather quiet but a very social one nevertheless. She had two close friends with whom she engaged in humorous conversation. She did not spend this time

to discuss her own or her friends' solutions. She worked in a concentrated way and spent a considerable amount of time on the details. She was perhaps the most careful of the students considering the design details in her solution. She seemed confident with herself and did not ask the instructors for help or ideas.

Student 7

Student 7 is female, and from Adiyaman. She has graduated from the public high school of Adiyaman Anadolu Lisesi, and her university entrance exam score is 202.842. Her CGPA is 3.27 for the time being, and her Design studio grades from his first year to this day are as follows: C+, B, C+, and B+.

She seemed motivated to begin the task and came prepared with her magazines, photocopies from books, and material samples. She used imagery and representation by sketching especially in the beginning phase to be able to set up the framework of what she wanted to show in her perspective. She worked almost without interruption and did not talk to her classmates very much. She talked the most during the critique she received from her instructor.

Student 8

Student 8 is female, and from Ankara. She has graduated from the private high school of TED Ankara Kolej, Vakfi Ozel Lisesi, and her university entrance exam score is 172.927. Her CGPA is 2.68 for the time being, and her Design studio grades from his first year to this day are as follows: C, C+, C-, and C.

This student was late for the studio and took her time in preparing for the task. She did not seem motivated and used a classmate's perspective to set up her own. She took

long breaks walking around and talking to her friends. She had trouble making efficient use of her time.

Student 9

Student 9 is female, and from Ankara. She has graduated from the private high school of AOD Tefev Ankara Ozel Tevfik Fikret Lisesi, and her university entrance exam score is 170.83. Her CGPA is 2.16 for the time being, and her Design studio grades from his first year to this day are as follows: B-, D+, D, and D.

This student is a rather quiet one but a social one, and although she did not seem motivated for the task, she came ready and worked at her desk only taking a break at lunch and a few to talk to her two close friends. During these breaks, they talked about the task, and discussed her own as well as her friends' projects. She worked with very little interruption and did not ask for help from the instructors until she was finished and was about to submit her perspective drawing. She seemed shy and was known for her fear of grades.

Student 10

Student 10 is female, and from Adana. She has graduated from the private high school of Ozel Cukurova BilFen Lisesi, and her university entrance exam score is 165.513. Her CGPA is 2.48 for the time being, and her Design studio grades from his first year to this day are as follows: C, B-, C-, and C.

This student was hard-working and came prepared to the class with books, magazines, and cut-out pictures. Although she seemed ready to solve the task, she was confused about the kind of atmosphere she wanted to achieve in her project and how to apply certain of the ideas she saw in the books. She lost a great deal of time just looking at the

books and magazines and could not finish her perspective and could not represent what she had visualized in her mind on paper.

Student 11

Student 11 is male, and from Ankara. he has graduated from the private high school of Ankara Kocatepe Mimar Kemal Lisesi, and his university entrance exam score is 151.944. His CGPA is 2.30 for the time being, and his Design studio grades from his first year to this day are as follows: C+, C, D+, and D+.

This student was on time and was very careful about schedules and requirements. He sat at his desk the whole day and gave only two breaks, one for lunch, and the other to talk to his friends at the next table. He was very concerned about grades and stated this fact repeatedly in his interviews. He used visualization techniques, but did not seem to be able to concentrate on anything. He had trouble in using imagery and visualizing a complete space in his mind.

Student 12

Student 12 is female, and from Ankara. She has graduated from the private high school of Ozel Ayse Abila Lisesi, and her university entrance exam score is 159.685. Her CGPA is 2.69 for the time being, and her Design studio grades from his first year to this day are as follows: B-, B+, C+, and C.

This student seemed very confident with herself and what she was doing. She spent a great deal of time talking to her friends, taking frequent breaks, and looking at others' drawings. However, towards the end of the day, she began speeding up in order to finish the task on time. She could not come close to finishing. She was one of the students who almost did not use any visualization techniques.

Student 13

Student 13 is female, and from Ankara. She has graduated from the private high school of Ozel Bilim Lisesi, and her university entrance exam score is 158.621. Her CGPA is 2.58 for the time being, and her Design studio grades from his first year to this day are as follows: C+, B, C-, and C-.

This student came late and spent some time talking to friends, but also spent some time sitting down and making use of alternating imagery and representation techniques. She would look up at the ceiling making facial expressions as if she was trying to figure something out, and then would draw a faint sketch. She then began her final perspective and came very close to finishing it.

Student 14

Student 14 is male, and from Ankara. He has graduated from the private high school of ODTU Gelistirme Vakfi Ozel Lisesi, and his university entrance exam score is 149.391. His CGPA is 1.86 for the time being, and his Design studio grades from his first year to this day are as follows: D+, C, D+, and C+.

This student did not concentrate nor use imagery techniques at all during the day. He did not even draw sketches, but directly prepared his paper and began drawing the perspective. He spent most of his time outside, walking around in the studio, or sitting at the desk but talking to his neighbors. He submitted his perspective at a very primitive stage although he used the whole day and did not submit it prior to the other students. He had trouble concentrating on the project and did not even want to be doing this task.

Student 15

Student 15 is male, and from Adana. He has graduated from the private high school of Haci Ahmet Atil Lisesi, and his university entrance exam score is 153.034. His CGPA is 1.96 for the time being, and his Design studio grades from his first year to this day are as follows: F (which he repeated and replaced with a C), D+, D, C+, and D+ (which he is repeating at the moment because of a low GPA).

This student spent most of his time at his desk, but also spared a considerable amount of time talking to his friends and engaging in humorous conversation. He looked around for ideas and had clearly not developed his initial ideas yet. He used very little imagery and representation, and did not use sketches, or books and magazines for inspiration.

APPENDIX F: DESCRIPTION AND SCHEDULE OF THE “THEME TRAIN” PROJECT

USED IN THE EMPIRICAL RESEARCH

IAED 301
INTERIOR DESIGN STUDIO III
Fall 2004
Project 2

Instructors: Şule Aybar
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THEME TRAIN

PURPOSE and EXPECTATIONS

Interior architecture aims at creating comfortable interior spaces of high aesthetical quality. In creating spaces the interior architect's tools are varied. Yet, among the most powerful are the materials, color and texture. You need to understand that different material, color or texture choices within an interior space lead to different ambiances. One of the purposes of 301 design studio is to introduce students to selection of materials, textures, colors and relevant lighting organizations in forming interior ambiances. There are many challenges in interior architecture. Sometimes the space may be too big, too high, too low, sometimes the functions may be too varied, too demanding (space-wise and facility-wise), too many. This semester, you will work on creating maximum use within a 'minimum' space. You are expected to make use of 'design details' in order to transform this limited space into a place with a unique character.

THE PROJECT

You are required to design one of the given interior space sets (set 1, 2 or 3) of a train. The train should have a theme. This theme will enable the travelers to live through the journey as a unique experience. The theme selection is up to you. However, to help you in determining your theme, note that the theme might be clientele-based (like 'youth' train), it might be route-based (like the "Orient Express"), or it might be fun-based (like a 'Music' train).

You are required to make the layouts of the chosen spaces according to the essence of the theme you select. However, for comfortable use you should also consider the design standards, ergonomics, and the fact that the train is moving! Therefore, enabling a safe journey is one of your constraints. You have to enhance the safety factors by paying attention to the non-slippery and non-flammable choices of materials. Naturally, you are responsible for taking the facts such as vibration and background noise into account while designing.

The selected public space (lounge, conference area, or restaurant) will be designed for 20 people within a separate wagon. You are responsible for locating a 7m² service area for any public space you choose, however you are not going to design the interior of this service area. Also, you are going to locate the WC's of the public space, whether you decide to design them or not.

Bedrooms will be located in wagons other than the public one. Each wagon must at least have 2 bedrooms. The typical bedroom should accommodate 2 people. Whether you design the interior or not, you should locate the WC of the bedroom.

Also keep in mind that you should provide adequate lighting, HVAC and sound systems in the spaces you design. In order to establish such systems, you may make use of the top (by suspended ceiling),

the sides (heating channels) and the bottom (by raised floor) of the train car. However, do not forget that the train cars have unique sections, and closing up the vaulted ceiling with a flat suspended surface will take away a lot from that unique character.

SPACE SETS

You need to select and design one of the space sets of the train:

Set 1: the lounge – typical bedroom – WC of the bedroom (with shower), or WCs of the lounge

Set 2: the restaurant – typical bedroom – WC of the bedroom (with shower), or WCs of the restaurant

Set 3: conference area – typical bedroom – WC of the bedroom (with shower), or WCs of the conference area

RESEARCH

You should carry out research on interiors of the trains, typical dimensions (especially for the corridor of the bedroom wagons), and furniture design appropriate for trains. Then, you need to present this research along with the theme you choose, sketches, images, photographs and initial decisions on a 50*70 opaque sheet. Make sure to decide on:

- how many bedrooms there will be in a wagon
- how many wagons there will be in the train (the train should have minimum 5 wagons!)
- what other functions can be proposed for the wagons in the train other than the given

PRESENTATION REQUIREMENTS

Preview:

Concept board

A key-plan showing how bedrooms will be located in a wagon

Board with references of the technical systems used for environmental control

For all three selected spaces:

material-furniture board

design details

For the typical bedroom:

1/20 plan

1/20 sections

1/20 reflected ceiling plan

interior perspectives from the eye-level, indicating how the space is lit

For the public space:

1/50 plans

1/50 sections

1/50 reflected ceiling plans

interior perspectives from the eye-level, indicating how the spaces is lit

For the WC:

1/50 plan

1/50 sections

1/50 reflected ceiling plans

For the public space and the typical bedroom:

1/50 models

Final jury:

Concept board

A key-plan showing how bedrooms will be located in the wagon

Board with references of the technical systems used for environmental control

For all three selected spaces:

material-furniture board

design details

For the typical bedroom:

1/20 plan

1/20 sections

1/20 reflected ceiling plan

interior perspectives from the eye-level, indicating how the space is lit

For the public space:

1/50 plans

1/50 sections

1/50 reflected ceiling plans

interior perspectives from the eye-level, indicating how the space is lit

For the WC:

1/50 plan

1/50 sections

1/50 reflected ceiling plans

For the public space and the typical bedroom:

1/50 models (with lights)

All drawings should be fully rendered.

