ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

IMAGINATION IN DESIGN THINKING: TRACKING THROUGH REPRESENTATION

M.Sc. THESIS

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Department of Architecture

Architectural Design Programme

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Ayşe Eda ADIGÜZEL, a M.Sc. student of İTU Graduate School student ID 502191001, successfully defended the thesis/dissertation entitled "IMAGINATION IN DESIGN THINKING: TRACKING THROUGH REPRESENTATION", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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To Adıgüzel Family,

FOREWORD

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IMAGINATION IN DESIGN THINKING: TRACKING THROUGH REPRESENTATION

SUMMARY

The thesis investigates the physical and mental factors on which the designer relies in the context of imagination, including the designer's design approach, design process, and design actions. In this context, imagination is explored through mental and external representation, both as a cognitive process and as a behavioral response, by playing an active role in design thinking. The potentials provided by this multi-layered and triggering structure of imagination establishes the motivation of the thesis for the establishment of tracking imagination through representation in design thinking. In this regard, the thesis aims to reveal the place of imagination in design thinking, the relationship it establishes with representation tools, and the commonalities and differences that occur in the design process depending on imaginative approaches. It is thought that the thesis will contribute to architectural education by opening new ways of approach in the context of imagination and creative approaches to architectural design thinking through representation.

As a result of the literature review, imagination is defined as “the ability to create images and ideas that are not present or real, mentally formed and expressed in the physical world”. The dialogue of imagination with concepts such as memory, perception, aesthetics, representation and creativity enables the thesis model to be built over four different functions. Accordingly, the functions of imagination are examined as associative, iterative, experiential and transformative. The thesis study aims to analyze the question of how these imagination functions are involved in the design process, and in this context, it is questioned whether there are design approach patterns under the influence of imagination.

Examining the associative function of imagination that connects concepts, the iterative function that provides the generation of ideas with alternative approaches, the experiential function that incorporates experiences into ideas, and the transformative function that enables the production of the new by focusing on change, establishes the thesis model and research method of it. The non-linear and undefined, multi-layered and cyclical state of the design process is seen as one of the main motivations for the study on the effect of imagination that is tracked through design representation. The representation of imagination in mental world focuses on schema theory. With the schema theory, in which the production of knowledge is examined as a process and the dynamism of the mental representation phenomenon is at the forefront, imagination includes the stages of activation, association and alteration in the design process.

Accordingly, the external representation acts as a bridge between the designer's mind and the physical world, plays a dialogic role to convey ideas, and acts as a trigger for the crystallization of the idea. External representation, which is divided into verbal and visual, is examined together with different tools and methods within the scope of the thesis. External representation tools analyzed as keywords, definitions, formulas, metaphors, narratives, reminders, plans, sections, perspective drawings, collages,

diagrams, storyboards, videos, physical models and digital models are included in the design process through design actions. Design actions which are examined as behavioral representation are studied as researching, analyzing, conceptualizing, creating spatiality, developing the idea, and conveying the idea. Within the scope of the thesis, the relationship between external representation, mental representation and design actions with imagination functions is revealed.

As a result, diagrams showing the relationship between design actions and imagination functions were produced and determined in order to carry out the case studies.. First phase of case studies was conducted in which the design diaries produced by the first year students of Bahçeşehir University Faculty of Architecture and Design, Department of Architecture were examined in the project course in the 2020-2021 Spring semester. With content analysis, it is explained with examples how students include external representation tools in the design process and examined in the context of their relations with imagination functions. The representations examined in the design diaries indicate that there are certain patterns in the design approaches of imagination functions, as well as differences and common behavior groups.

The question of how imagination is involved in design thinking is followed by disassembling the design processes of the students beyond what is conveyed in the design diaries. For this, semi-structured in-depth interviews were conducted with architecture students. In order to examine their use of imagination and design approaches, 15 first-year students were included in the interviews. In addition to this interview group, in-depth interviews were conducted with 7 fourth-year students, who were at the last stage of their architectural design education, in order to make comparisons. All of them were asked to describe the design process they went through during the term. The design processes of the students are analyzed by coding the interviews according to the representations used and design actions. With this analysis under the name of imagination mapping, design process charts are created in which the keywords that students focus on, imagination function intensities associated with the actions, and the representation tool, action and imagination functions can be followed together.

When imagination mapping is examined, it is seen that imagination functions create common behavior groups, common design approach patterns and differences in design thinking. While it has been determined that associative and iterative functions, which are among the functions of imagination, are heavily involved in the design process, design actions and representations that come together are considered as phenomena specific to design thinking of the students. Imagination functions that enable the formation of common patterns also reveal six different behavior groups. The differences in design approaches and design processes of first and fourth year students also make it possible to follow the approach offered by architectural education. These patterns and groups, which can be examined in architectural design education, enable the questioning of educational approaches and searching for potentials for triggering creative processes offered by imagination. Identified patterns and groups attribute the dialogical, organic and dynamic nature of imagination to the design process. As a result, within the architectural design practice, imagination is involved in every moment of the design process with its different functions and is considered as a creative potential that diversifies design approaches.

TASARIM DÜŞÜNCESİNDE HAYAL GÜCÜ: TEMSİL ÜZERİNDEN TAKİBİ

ÖZET

Tasarımcının tasarım yaklaşımı, tasarım süreci ve tasarım eylemlerini içeren tasarım düşüncesinin araştırıldığı tez, tasarımcının bağlı olduğu fiziksel ve zihinsel faktörleri hayal gücü bağlamında odağına alır. Fikir ve imge üretme hali olarak tanımlanan hayal gücü tasarım sürecinde tasarımcının bilinçli ve bilinçsiz olarak gerçekleştirdiği eylemlerle ilişkiye girer. Bu ilişkiler bütünü ile tasarım düşüncesi çok katmanlı bir süreç olarak incelenir. Bu bağlamda hayal gücü, tasarım düşüncesinde aktif rol oynayarak hem bilişsel bir süreç hem de davranışsal bir tepki olarak zihinsel ve dışsal temsil yoluyla araştırılır. Hayal gücünün bu çok katmanlı ve tetikleyici yapısının sağladığı potansiyeller tasarım düşüncesinde temsil yoluyla takibin kurulmasına yönelik tezin motivasyonunu oluşturur. Bu bağlamda tez, hayal gücünün tasarım düşüncesi içerisindeki yerini, temsil araçlarıyla kurduğu ilişkiyi ve bunlara bağlı olarak tasarım sürecinde oluşan ortaklık ve farklılıkları ortaya çıkarmayı amaçlamaktadır. Tez çalışmasının mimarlık eğitimine hayal gücü bağlamında yeni yaklaşım yollarının ve mimari tasarım düşüncesine temsil üzerinden yaratıcı yaklaşım yollarının açılmasıyla katkı sağlayacağı düşünülmektedir.

Tasarım düşüncesinde hayal gücünün yerinin sorgulandığı tez çalışması, hayal gücünün farklı literatürlerdeki kapsamlarının belirlenmesiyle başlar. Literatür taraması sonucu hayal gücü "mevcut veya gerçek olmayan, zihinsel olarak şekillendirilmiş ve dış dünyada ifade edilen imgeleri ve fikirleri yaratma ve oluşturma yeteneği" olarak tanımlanır. Hayal gücünün bellek, algı, estetik, temsil, yaratıcılık gibi kavramlar ile olan diyaloğu tez modelinin dört farklı fonksiyon üzerinden kurulmasını sağlar. Buna göre hayal gücünün fonksiyonları ilişkisel, yinelemeli, deneyimsel ve dönüştürücü olarak incelenir. İncelenen ve öne sürülen hayal gücü fonksiyonları imge ve fikirlerin oluşumuna ve gelişimine aktif olarak katılır. Tez çalışması bu hayal gücü fonksiyonlarının tasarım sürecine nasıl dahil olduğu sorusunu çözümlemeyi hedefler ve bu bağlamda hayal gücünün etkisinde tasarım yaklaşımı örüntülerinin var olup olmadığı sorgulanır.

Hayal gücünün kavramlar arasında bağlantı kuran ilişkisel fonksiyonunu, alternatif yaklaşımlarla fikir üretimini sağlayan yinelemeli fonksiyonunu, deneyimleri fikirlere dahil eden deneyimsel fonksiyonunu ve değişimi odağına alarak yeninin üretilmesini sağlayan dönüştürücü fonksiyonunu tasarım düşüncesi içerisinde incelemek tezin çalışma modelini ve araştırma yönteminin temelini kurar. Tasarım sürecinin doğrusal ve tanımlı olmayan, çok katmanlı ve döngüsel hali hayal gücünün etkisinin araştırılması konusunda tezi besleyen ana motivasyonlardan biri olarak görülür. Tasarım düşüncesinin mimarlık ile olan ilişkisi dahilinde tez çalışması mekansal tasarım süreçlerine odaklanır. Buna göre mimari tasarım süreci doğrudan algıları, deneyimleri, tasarım bilgisini ve yapma eylemini hayal gücü ile bağdaştırır ve yaratıcı yaklaşımların oluşmasını sağlar.

Hayal gücü fonksiyonlarının tasarıma dahil edilme hallerinin tasarım sürecini çeşitlendirdiği öngörülerek bu fonksiyonların kapsamı belirlenir. Bu bağlamda bu fonksiyonların tasarım sürecine temsil mediaları ve tasarım eylemleri ile dahil olduğu savı ile ilerlenerek tasarımda temsil-hayal gücü ilişkisine odaklanılır. Tasarım sürecinde ve tasarım düşüncesinde hayal gücünün takibi temsil kavramı üzerinden yapılmaktadır. Hayal gücünün temsilinin zihinsel temsildeki karşılığı bilginin temsili konusuna da değinerek odağına şema teorisini alır. Bilgi üretiminin süreç olarak incelendiği ve zihinsel temsil olgusunun dinamikliğinin ön planda olduğu şema teorisi ile hayal gücü aktivasyon, çağrışım ve değişim evrelerini tasarım sürecine dahil eder. Böylece tasarımcının zihnindeki bilgiler hayal gücü fonksiyonlarının etkisiyle aktive edilir, özellikler adapte edilir ve dönüştürülür, deneyimlere göre şekillenir, yeni fikirler ve imgelerin oluşturulmasında şemalar arası ilişkiler kurulur.

Zihinsel temsilin ötesinde tasarım sürecinin ana girdi ve çıktısını oluşturan dışsal temsil konusu tez hipotezinin araştırılmasında ana odaktır. Buna göre dışsal temsil, tasarımcının zihniyle fiziksel dünya arasında köprü görevi görür, fikirleri aktarmak için diyalog kuran bir rol üstlenir ve fikrin kristalleşmesi için tetikleyici bir etki gösterir. Dışsal temsilin bu ilişkisel durumu hayal gücüyle doğrudan bağlantı kurar ve fonksiyonlarının dışsal temsil üzerinden takip edilmesine olanak sağlar. Sözel, görsel ve davranışsal olarak ayrılan dışsal temsil, tez kapsamında farklı araçlar ve yöntemler ile birlikte incelenir. Buna göre davranışsal dışsal temsil tasarım eylemleriyle bağdaştırılır. Anahtar kelime, tanım, formül, metafor, anlatı, hatırlatıcı, plan, kesit, perspektif çizim, kolaj, diyagram, storyboard, video, fiziksel model ve dijital model olarak incelenen dışsal temsil araçları tasarım eylemleri ile tasarım sürecine dahil edilir. Tasarım eylemleri araştırmak, analiz etmek, konsept oluşturmak, mekansallık oluşturmak, fikri geliştirmek ve fikri aktarmak olarak incelenir. Tez kapsamında dışsal temsil, zihinsel temsil ve tasarım eylemlerinin hayal gücü fonksiyonlarıyla olan ilişkisi ortaya konur. Böylece hayal gücünün kapsamı belirlenir ve tasarım süreçlerinde temsil yoluyla yaratıcı yaklaşımları zenginleştiren bir olgu olarak incelenir. Tezin temel motivasyonu, çok fonksiyonlu hayal gücünün bir tasarım becerisi olarak görüldüğü çerçevede, tasarım sürecinde oynadığı rolü temsil ile deşifre etmektir.

Hayal gücü ve tasarım eylemlerine ilişkin önerilen model ile tasarımcı ana özne olarak teze dahil edilir. Sonuç olarak, alan çalışmalarını gerçekleştirmek için tasarım eylemleri ile hayal gücü işlevleri arasındaki ilişkiyi gösteren diyagramlar üretilmiş ve örnek olay çalışmalarında odaklanılacak ve aranacak temsiller ve eylemler belirlenmiştir. Alan çalışmasının ilk aşamasında Bahçeşehir Üniversitesi Mimarlık ve Tasarım Fakültesi, Mimarlık Bölümü birinci sınıf öğrencilerinin 2020-2021 Bahar yarıyılında proje dersinde ürettikleri tasarım günlükleri incelenmiştir. Birinci sınıf öğrencilerinin odağa alınmasının sebebi temsil araçlarıyla yeni tanışan ve hepsini aynı dönem içerisinde kullanmaları beklenen öğrenci grubunun bu bağlamda kendi tasarım yaklaşımlarının ham bir şekilde incelenebilecek olmasıdır. Tasarım günlüklerinde kullanılan temsil araçları ve tasarım eylemleri incelenerek içerek analizi yapılmıştır. İçerik analizi ile öğrencilerin dışsal temsil araçlarını tasarım süreçlerine nasıl dahil ettikleri örneklerle açıklanır ve hayal gücü fonksiyonları ile ilişkileri bağlamında incelenir. Bu çalışma sonucu teorik çerçeve içerisinde araştırılan dışsal temsil araçlarının kapsamı hayal gücü fonksiyonları ile yeniden oluşturulur. Bu bağlamda tasarım günlükleri ile öğrencilerin farklı temsil araçlarıyla birlikte farklı tasarım yaklaşımlarına sahip oldukları ve tasarım eylemlerini de bu yaklaşımlarla ilişkili olarak aktive ettikleri sonucunu ortaya çıkartır. Tasarım günlüklerinde incelenen

temsiller hayal gücü fonksiyonlarının tasarım yaklaşımlarında belirli örüntüler olduğu gibi farklılıkların ve ortak davranış gruplarının olduğuna da işaret eder.

Hayal gücünün tasarım düşüncesine nasıl dahil olduğu sorusu tasarım günlüklerinde aktarılanın ötesinde öğrencilerin tasarım süreçlerinin söküme uğratılmasıyla takip edilir. Bunun için mimarlık öğrencileriyle yarı yapılandırılmış derinlemesine görüşmeler yapılmıştır. Görüşmelere ham hayal gücü kullanımlarını ve tasarım yaklaşımlarını incelemek üzere mimari tasarım eğitiminin tamamını deneyimlemedikleri için 15 kişiden oluşan birinci sınıf öğrencileri dahil edilmiştir. Bu görüşme grubuna ek olarak karşılaştırma yapabilmek adına mimari tasarım eğitimlerinin son aşamasında olan 7 kişiden oluşan dördüncü sınıf öğrencileriyle derinlemesine görüşmeler yapılmıştır ve hepsinden dönem içerisinde geçirdikleri tasarım sürecini anlatmaları istenmiştir. Alan çalışmasının bu aşaması ile öğrencilerin tasarım süreçlerinde kullandıkları eylemlerinn, temsillerin, düşüncelerin ve yaklaşımların ortaya konulması hedeflenmektedir. Görüşmelerin kullanılan temsillere ve tasarım eylemlerine göre kodlanması ile öğrencilerin tasarım süreçleri analiz edilir. Bu analiz ile öğrencilerin tasarım süreçlerinde odaklandıkları anahtar kelimeler, eylemlerle ilişkilenen hayal gücü fonksiyonu yoğunlukları ve temsil aracı, eylem ve hayal gücü fonksiyonlarının bir arada takip edilebildiği tasarım süreci çizelgeleri oluşturulur. Temsil üzerinden takip kurularak oluşturulan bu çizelge ve grafiklerin bütünü hayal gücü haritalaması adı altında tezin yöntemini oluşturur.

Hayal gücü haritalamaları incelendiğinde, hayal gücü fonksiyonlarının tasarım düşüncesinde ortak davranış grupları, ortak tasarım yaklaşımı örüntüleri ve bunların içinde farklılıklar yarattığı görülür. Hayal gücü fonksiyonlarından ilişkisel ve yinelemeli fonksiyonların yoğun olarak tasarım sürecine dahil olduğu saptanırken bunların bir araya geldiği tasarım eylemleri ve temsiller tasarım düşüncesini biricikleştiren olgular olarak değerlendirilir. Böylece hayal gücü, tasarım süreçlerinde temsil yoluyla yaratıcı yaklaşımları zenginleştiren bir olgu olarak ele alınır. Ortak örüntülerin oluşmasını sağlayan hayal gücü fonksiyonları aynı zamanda altı farklı davranış grubunu da ortaya çıkarttığı tespit edilmiştir. Bu davranış gruplarının hayal gücü fonksiyonlarının belirli sıra veya yoğunlukla kullanılması sonucu tasarım yaklaşımı olarak öğrencilerin tasarım sürecini yönlendirdiği sonucuna ulaşılmıştır. Temsil ile kurulan doğrudan ilişki içerisinde tasarım yaklaşımlarının inceleniyor olması gruplar ve örüntüler içerisinde farklılıkların ortaya çıkmasını sağlamaktadır. Bu farklılıklar hayal gücünün taşıdığı potansiyelli durumun bir sonucu olarak değerlendirilmiştir. Birinci ve dördüncü sınıf öğrencilerin tasarım yaklaşımları ve tasarım süreçlerindeki farklılıklar mimarlık eğitiminin sunduğu yaklaşımın takibini de mümkün kılmaktadır. Mimari tasarım eğitimi içerisinde incelenebilecek olan bu örüntü ve gruplar eğitim yaklaşımlarının sorgulanmasını ve hayal gücünün sunduğu yaratıcı süreçlerin tetiklenmesine yönelik potansiyellerin aranmasını sağlamaktadır. Bu durumda hayal gücü, tasarım düşüncesinde kullanılan temsil araçları ve tasarım eylemleri ile kurduğu ilişki dahilinde rol üstlenmektedir. Tespit edilen örüntüler ve grupların hayal gücünün diyalog kuran, organik ve dinamik yapısını tasarım sürecine yansıttığını göstermektedir. Sonuç olarak mimari tasarım pratiği içerisinde hayal gücünün, tasarım sürecinin her anına taşıdığı farklı fonksiyonlarla dahil olduğu ve tasarım yaklaşımlarını çeşitlendiren yaratıcı bir potansiyel olarak yer aldığı görüşmüştür.

1. INTRODUCTION

1.1 Looking Through Imagination

Design thinking is defined as a creative and practical notion that examines the designer's approach, process, and actions to solve problems with design ideas. In design thinking, there are many physical and mental factors that the designer depends on. In the thesis, both physical and mental factors are intersected with imagination and related in design thinking Based on this definition, architecture intersects with design thinking considering the relationship between architectural design processes and creative problem-solving approaches. The relationship of architectural design with creativity is seen as the most fundamental part of design process as shaped by imagination. The design process, which develops via experiences lived and the knowledge gained, diversifies, alternates, and re-establishes its layers with the parameters set by its designer. In this case, the design process emerges as the process of solving a problem by designing, and the solution occurs between these layers with the direct or auxiliary effect of imagination. At each layer and each phase of design process, there are accumulations, separations, combinations and changes both in mental representation and external representation.

Imagination, that provides desire to produce novel ideas and images and determines the actions, both consciously and unconsciously, creates a multi-layered process by associating with all other mental processes (Liao & Gendler, 2020) in design thinking. Imagination helps to create the state of being creative of this mental process that differentiates and unifies the design. The main motivation of the thesis is to determine the potentials of imagination in design thinking and design process. In this context, imagination can be investigated through mental and external representation by playing an active role in creating the design, developing the design and solving the problem, both as a cognitive process and as a behavioral response. Thus, the aim of the thesis is to search for answers of how imagination is involved in architectural design thinking. The main hypothesis proposed in the thesis is that; imagination with its different functions can be involved and searched in design process through mental and external

representation, can direct the design and be associated with design inputs and outputs. In this case, imagination creates common behavior groups, common patterns and differences within them in design thinking. Thus, imagination can be examined as a phenomenon that enriches creative approaches through representation in design processes. In this context, imagination will be searched in the literature, the functions of imagination will be determined in the focus of design thought and how they are included in the architectural design process in relation to representation will be investigated.

First, it is necessary to explore the scope of imagination. When "imagination" and its meanings in Cambridge, Merriam Webster and Oxford English Dictionaries are examined, the common definition shows itself as "the ability to create and form images and ideas that are not present or real, shaped mentally in mind and expressed in the external world". Although imagination has different and multi-layered counterparts in psychology and philosophy, its meaning common to all corresponds to the generation and development of ideas by associating the mental process with the physical world. Imagination and its functions have different characteristics in terms of their relations with remembering, creativity, belief, perception, dreaming, desire etc. (Liao & Gendler, 2020). Imagination helps to produce combinations of all the knowledge in our minds to form novel ideas. The thesis focuses on imagination as an ability associated with the act of creation. As a cognitive process, imagination not only associates itself with memory but also has the potential to reveal unlived and unrealistic ideas. The scope of the thesis established with the definition of imagination represents the integrity of knowledge in memory and creatively stratified and differentiated ideas.

Considering its relation to consciousness, memory, representation, creativity, and cognitive processes, functions of imagination are covered in various classifications. In this case, imagination has the ability to use the information in memory to make combinations to generate new information. Beyond that, imagination uses past experiences to produce ideas, as well as phenomena such as emotion, feeling and perception. As a result of its emphasis on production and creation, imagination actively participates in the formation and development of images and ideas, as well as in the creation of its functions. These functions of imagination, are examined in the thesis under the titles of associative, experiential, iterative and transformative by focusing on

design. Imagination activates itself at different phases of the design process with all its functions. One of the motivations of the thesis is to decipher the role it plays in the design process within the framework where imagination with multiple functions is considered a design skill, therefore, a potential to design. From this point of view, imagination creates the design process itself with all the functions it contains and unifies the process.

The phenomena investigated within the framework of imagination and creativity in child psychology are the novelty and multiplicity of the ideas produced (Kupers et al., 2019). According to Vygotsky (2004), the increase in solution alternatives to a problem is directly proportional to imagination of the individual. In this case, where the act of creation is at the forefront, imagination is examined as the phenomenon that establishes creativity. Whereas, even if the created alternatives are produced by different mental processes, they require effort and strength contrary to mere thinking. These mental processes are related to the designer's experiences, perception, and therefore memory and knowledge. This shows the existence of various inputs influenced by imagination that diversify the design process. While the thesis reveals all functions of imagination related to mental processes mentioned, it aims to acknowledge the effectiveness and mapping of imagination in design thinking throughout the design process. Combining images and ideas of the designer’s memory in novel thinking is the primary approach of imaginative thinking in the design process. Therefore, the creative imagination is acknowledged as the creating perception of alternative realities and experiences connected to transcendent use of imagination by Kind and Kung (as cited in Liao & Gendler, 2020). Imaginative thinking related to creativity observes the design thinking with features such as “vividness, originality and transformativeness” (Jankowska & Karwowski, 2015). Therefore, the thesis focuses on imagination’s functions emphasized as associative, iterative, experiential and transformative. These functions also shape the model of the thesis research by creating a scope and show the features of creativity based on imagination in the design process.

The fact that imagination reveals its different functions simultaneously with creative thinking represents the uniqueness of design processes. Beyond the phenomena represented by imagination, the question of how imagination is represented in design thinking is one of the main questions of the study. Imagination, which can be called a

cognitive process or ability, is associated with the mind. The functioning of the memory gives information about the formation of the mental model shaped by imagination. In this framework, imagination continues to reflect its characteristics while establishing its representational model in the mind.

Although imagination is a cognitive ability, it does not make its representation only in mental environment. Folkmann, (2010) in his work on creativity in design, takes imagination as a dynamic structure that provides a dialogue between mental and external representations and establishes this dynamism through the relationship between activities during the design process. Thus, it regards imagination as the main element that provides this dynamism and gives creative power to design, rather than being a tool or an occasional situation. Representation methods that enrich and stimulate thought during the design process, and at the same time enable various dialogues to be established, facilitate the diversification of design outputs. While these outputs provide differences in approach to the problem, they also represent the functions of imagination involved in design. The fact that this dialogue is perceived by the designer on a continuum describes the position of imagination. Although it does not define a precise place in either mental representation or external representation, imagination is seen as an intermediate state involving both. In this context, imagination ensures to reveal and follow the patterns of design approaches both in the process of establishing the mental model and in the actions within the production of external representation.

Spatial perception during the formation of architectural design becomes possible with the physical presence of imagination in representation. Considering the design processes, physical activities that work simultaneously with the cognitive activities form the backbone of design related to representation media. Decision-making stages within the established activities (Akın & Lin, 1995) reveal the functions of imagination. Although imagining is not just a mental activity, it becomes bodily and visually perceptible by its external representation. As it is represented in both environments, different functions of imagination come into play in design process. How these functions affect design, and how they enable to follow patterns of design approaches are among the main questions of the study. With this study, it is thought that examining imagination with its functions by associating it with the actions created in both mental and external representation media will reveal creative approaches in the

design processes and contribute to architectural design thinking by handling it as a process that builds relationships between representation media and imagination.

1.2 Aim and Method

The design process highlights the definition of imagination by enabling a mapping demonstrating usage of functions of imagination. Different functions of imagination are explored through representation media and design actions used in design thinking within the scope of the thesis. The aim of the thesis is to determine the scope of imagination with its functions and to investigate how these functions are represented in the design process. The thesis' main discourse is that imagination, which is included in the design process and discussed in the context of creativity, contributes to design with its various functions and provides a different perspective on the concept of creativity. Throughout this context, it is possible to say that the actor, that is, the designer, who is the source of this imagination, is the focus of the thesis. The dialogue between the designer's binary relations such as mind-body, abstract-concrete, reality-fantasy, and problem-solution (Cross, 2013) is discussed with the inclusion of the designer's imagination in design. The goal of this thesis, in which imagination is viewed as a dialogic element in design, is to disassemble the architectural design process and re-explore it with the focus of imagination.

The thesis aims to find the scope of imagination in design by investigating the definitions of design process in psychology and philosophy. In this context, the thesis considers the design process as a variable and dynamic structure with the effect of imagination, rather than defining it as a systematized or intuitive situation. By drawing attention to the potentials that ensure the continuity and diversity of the design process, the existence of imagination is sought with the determined functions. Contrary to theories and discussions in which imagination is divided into classifications, the thesis is handled as a unity that consists of a variety of functions that are discussed as associative, iterative, experiential and transformative. Functions that come out as a result of this investigation provide a holistic view of imagination with their features.

One of the points that the thesis draws attention to is that imagination is considered a process and a dynamic model tracked through representation media. Along with the theories for mental representation that will be detailed in Chapter 3, Schema Theory considers mental representation as a process and presents it as an ever-changing and

experiential model related to behavioral and cognitive activities (Mcvee et al., 2005). With this model, the counterpart of imagination in the mind is evaluated within the process of formation of ideas. The stages in which the designer's imagination is involved in the design process are explored using the Schema theory. The mental schemata are described with the stages of activation, association and alteration, likewise included in the design with the mental actions it contains; remembering, revealing information, categorizing, combining, inferring, abstracting, creating, modifying and sensing. Differentiating schemata and their phases are examined with the functions of imagination in the design process.

The dialogue between mental and external representation media can be examined within the scope of design thinking. The relationship between the two media also enriches the designer's behavior and design actions. At this point, the role of the external representation media used by the designer in the design process can be discussed in the context of its relationship with the functions of imagination. While external representation can be thought of as a representation media where what is produced in the mind corresponds to the physical world, it can also shape the thought in the mind as a result of the potential it contains. This situation is related to the verbal or visual representation of external representation, and there are different potentials that the designer benefits from in both forms of representation. In this case, imagination uses external representation both as a tool and as a design product in the design process. Considering the relationship between architectural design process and external representation, the use of different representation media from analog production to digital, from drawing to modeling makes it possible to investigate the hypothesis that imagination enables the revealing of patterns in design approaches.

Although external representation methods seen in this context are divided into verbal and visual, attention is drawn to the observation of the design actions which are considered as the forms of behavioral representation. At this point, design actions offer various approaches to the production of representation and make sense of the design process. Within the scope of the thesis, design actions are defined, categorized and researched by focusing on the subject of representation. With this approach and definition, design actions are categorized as investigating, analyzing, generating concepts, generating spatiality, developing design and communicating ideas. By making use of the design literature with the thesis research, the main design actions

for external representation are separated into sub-actions and the operational components of the design process are established. The relationship between the actions that establish the thesis model and imagination is examined through representation, and it is formulated which actions are processed together with which imagination functions in the design process. As a result, diagrams showing the relationship between design actions and imagination functions are produced to carry out the case studies, and the representations and actions to be focused on and searched for in the case studies are determined.

While it is not argued that the design process is completely formed by imagination, at what stages and in what capacity imagination is involved in the design process is investigated. In this context, imagination, which enriches and activates design actions, is seen as the motivation of the thesis for the research of design thinking. The potentials of the situations where design methods and imagination intersect and their effect on design are discussed. Because the methods and actions that structure the design process seem possible with the diversified dialogue created by imagination. In this context, the point that draws attention is that the design approaches may contain certain behavior groups as well as individual differences. While it is possible to talk about the existence of certain stages in the design process, representation tools and actions used can be exemplified as notions that make a difference in the design approach in which different functions of imagination are involved in process. With this double reading, the classified actions are coded and associated with imagination. The actions of representation that are questioned through different forms of creativity and therefore imagination are seen as supporting the architectural design processes.

Research on the designer and the design process is carried out in the thesis, which proceeds with the hypothesis that the relationship between imagination, representation, and design actions enables the formation of differences and patterns in design approaches. The motivation to reveal the potentials of imagination in the design process gains meaning in the diversity and non-linear process in architectural design education and the fact that it is discussed in the context of education establishes the method of the thesis. Accordingly, design diaries prepared by the first-year students of Bahçeşehir University Architecture Department in the spring term of 2020-2021 academic year are examined as the first phase of the case studies. The relationship between the representation media used by students in the design process and design

actions were examined, thus the study was conducted to determine the roles of functions of imagination in the architectural design process. The analysis was carried out by examining the representation media used by students in the design diaries they submitted at the end of the semester and by making a content analysis of them. The content analysis was continued by revealing the representation media used in the design diaries and thus examplifying with which actions the students used these representations together. For this reason, the first phase of the case studies provides the testing of the established model and the examination of imagination in the context of the architectural design process, thanks to the design processes that the students conveyed in their diaries.

Design actions and representation media used in architectural education are deciphered within the scope of the analysis of design diaries. The case studies continue with the analysis of the design processes focusing on the first-grades and for the comparison with fourth-year architecture students studying at the Department of Architecture at Bahçeşehir University. Backtracking to imagination through representation is revealed with in-depth interviews with these students and they are asked to describe their previous design processes of architectural studios in their architectural education during these interviews. The data obtained as a result of the interviews is deciphered with the model established through the codes and relations between imagination, design actions and representation media. Thus, the mappings of students' design processes are revealed with these codes and revealing the design processes in the context of representation with these coding provides a trace back to the imagination. Representation methods and their associated actions are identified in these mappings. Functions of imagination are investigated by mapping the timeline of the design process of students, which is divided into stages according to representations and actions employed, and thus, the design approach provoked by imagination is questioned. In addition, the keywords that help students create and develop their designs were examined and the relationship of these keywords with the approaches established by imagination functions was discussed within the framework of the model created by the thesis. With this method, the diversity of the design actions examined together with different functions of imagination can be discussed, and the ways of using imagination of the students who draw their routes in the design processes can be investigated. In this context, the process of both mental and external representation

based on actions in design are emphasized by underlining the roles of the functions of imagination on design approaches of students. Imaginative approaches provided by students' design process mappings reveal the common patterns of design approaches and common behavior groups followed through design thinking. Thus, the purpose of this thesis is to investigate the relationship between the functions of imagination and design actions, as well as to track how imagination is included in the design process using this relationship. As a result, the analyzed interviews reveal students' common design processes, common behavior groups through design approaches and different design decisions, and enable the design thinking to be tested in line with the thesis hypothesis in the context of its relationship with imagination functions **(Figure 1.1**).

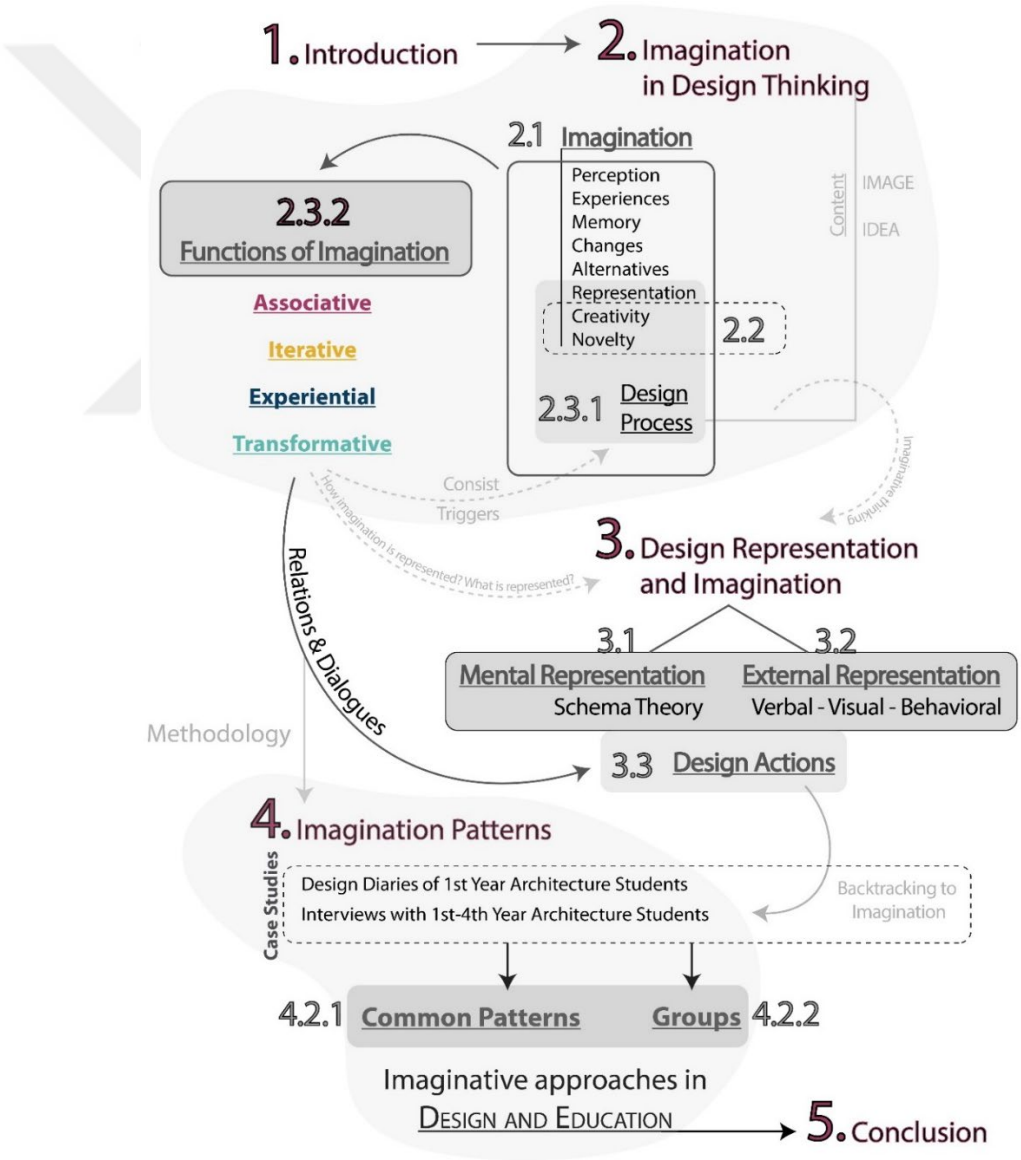

Figure 1.1 : Thesis structure (Adıgüzel, 2022).

In this context, the thesis reveals both the similarities and differences between the design processes established between mental and external representation, as well as the functions of imagination that define the design process, and discusses how design approaches can be strengthened in architectural design education. When the design actions and practices acquired by designers based on architectural design education are considered in broad scope, the designer's approach to the design problem can be mapped within this framework. Although imagination is seen as an element supported in design education, how it works in the studensts' mind is investigated in the representation mechanism based on educational practice. In this context, the students' design actions in producing images and ideas are related to the functions of imagination. The thesis aims to explore this relationship in the design processes of students carried out in architectural design education and to reveal the scope of imagination by searching for representational patterns in the imagination mapping of them. The thesis is intended to contribute to architectural education by introducing new standpoints on imagination and creative approaches to architectural design thinking through representation.

2. IMAGINATION IN DESIGN THINKING

2.1 Exploring Imagination

Defining imagination as the ability to produce ideas and develop the existing innovatively, and to evaluate it as cognitive activity makes it a subject still discussed in philosophy and psychology. First, the scope of imagination can be discussed when the dictionary meaning and its etymology are examined. Imagination has its roots in the Latin verb "*imaginari*" which means “to picture oneself” and appears when the imagining verb becomes a noun (Perdue, 2003). The word “imagination”, which can be derived and associated with words such as image, imagery, imaginary, imaging, etc., was first used in the 14th century with the definition of "the act or power of forming a mental image of something not present to the senses or never before wholly perceived in reality” as defined in the Merriam-Webster Dictionary. When the origin of the word is described as action, imagination is associated with the production of images in mind (**Figure 2.1**). However, the next sections will discuss whether the mind produces only images. Although imagination seems to indicate a single act, it diversifies its meaning by creating relationships with other cognitive processes, social, cultural and physical factors.

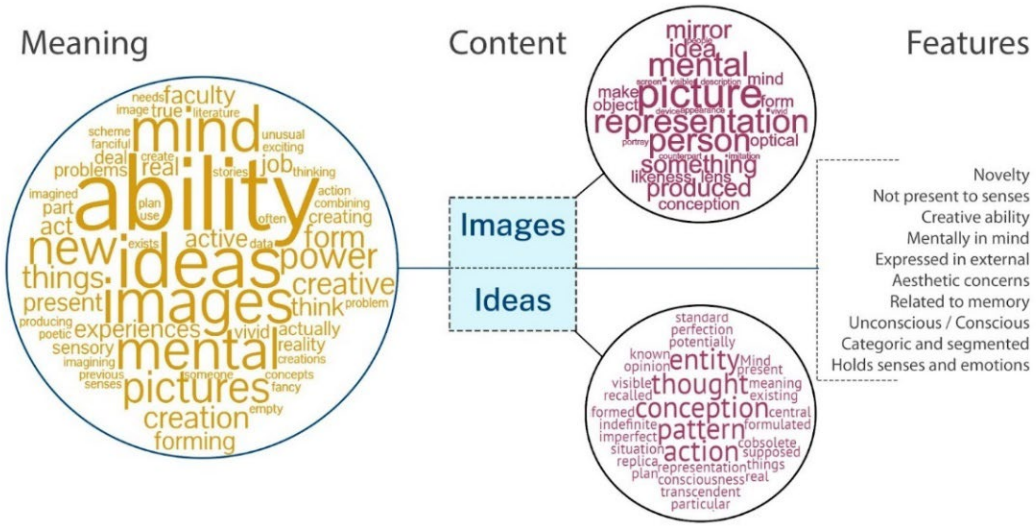

Figure 2.1 : Meaning and content of imagination (Adıgüzel, 2022).

When viewed from a historical perspective, it is examined together with concepts such as fancy, fantasy and dream. The Cambridge Dictionary defines the word "fantasy" with the verb to imagine and associates it with desire in its primary definition. As in the Encyclopedia Brittanica, Coleridge stated imagination as an ability that is related to creativity, he defined fancy as merely associative and sub-case of imagination ("Fancy", 2000). The word "fantasy" (phantasy) is also defined with the word imagining and originates from "fancy" related to the Greek word "phantasia". By defining fantasy, it is possible to clarify emotions such as pleasure and desire. Additionally, it involves imageries of magical or unreal situations as well. The word "dream" has different meanings than fancy or fantasy. For example, it can happen while the person is unconsciously asleep, or is associated with a goal-driven by desire. However, in "dream"s definitions, imagining or image can be seen as explanatory words. In that manner, we can conclude the synonyms of imagination as the subcase of the action "imagining". Imagination comprises new thoughts, situations and actions produced by the mind, that is, fancy, fantasy and dreams are included in the scope of imagination. Beyond the dictionary definitions of imagination, it appears in the literature with various meanings and, as a result, it is associated with various concepts. Accordingly, within the scope of the thesis, imagination is expanded on the basis of the concepts summarized in **Figure 2.2** in this section.

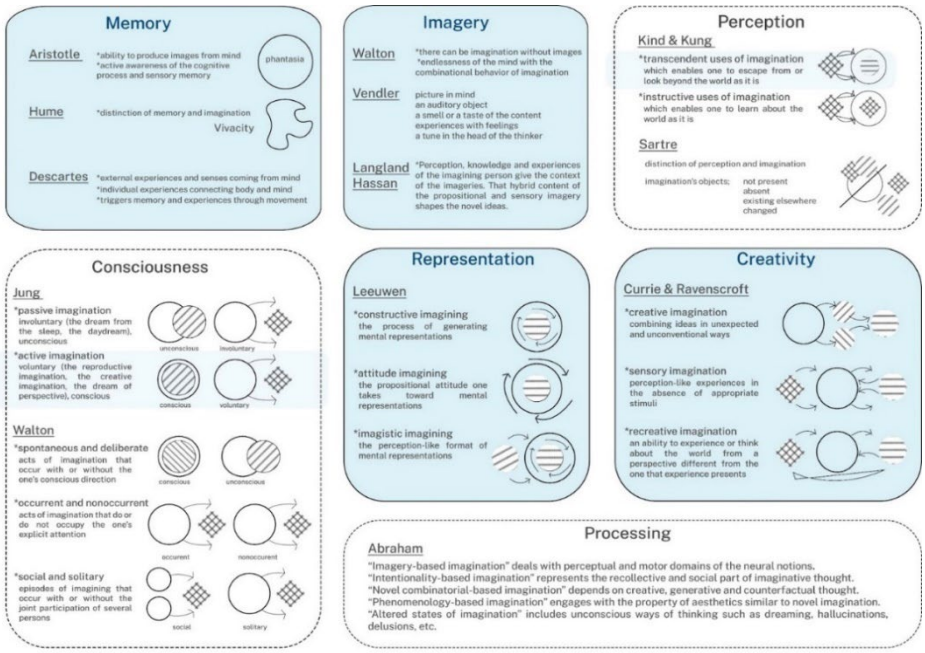

Figure 2.2 : Literature on imagination's scope (Adıgüzel, 2022).

To discuss synonyms and their related historical critics in-depth, Aristotle's (*De Anima* iii 3, as cited in Shields, 2020) phantasia which is thought of as imagination is described as an ability and a virtue to produce images from mind. In that description, images are included in the discussion as a thought scheme. The virtue in Aristotle's description gives a trace for distinguishing perception and imagination. Phantasia is thought of as movement that is an active awareness of the cognitive process and sensory memory (Modrak, 2016). By describing imagination as an active movement, perception differentiates from imagination by discussing the cognitive conditions as true and false, or present and not present. Imagination is seen as a cognitive faculty of not present events whether they are true or false. His discussions about imagination and perception indicate that imagination takes place in the mind as an ultimate cognitive source and is associated with the capacity of the mind as a power to produce novel ideas (Modrak, 2016). Although, when phantasia is described as sensory representation, it acts as a medium for memory. Memory affects and changes the motion of imaginings and imagination is involved in memory as a cognitive process. In this case, perception and memory can be discussed in the context of their relations with imagination. Thus, considering the relationship of imagination with sensations, it is understood that it is not independent of the perception formed by the experiences and the memory in which the experiences take place as moving images in mind.

According to Descartes, external experiences and the senses that are coming from the mind shape imagination (as cited in Sepper, 1996). From his discussions on common sense, external and internal linkages describe imagination as a bodily movement (as cited in Sepper, 1996). Starting from Aristotle's cognitive movement of images and Descartes' individual experiences connecting body and mind, imagination can be examined as a faculty that triggers memory and experiences through movement. When looking at the relationship between imagination and memory, although it seems that they enrich each other, they differ from each other due to casual connection criteria. Hume distinguishes memory and imagination from each other by identifying them with the ideas they produce (Dorsch, 2015). Vivacity, which is the term used for determining the liveliness and the strength of the idea, distinguishes memory from imagination (as cited in Dorsch, 2015). Imagination is identified with ideas of fancy and ideas of judgment and linked to the perceptual experiences that are not present. On the other hand, ideas of memory are related to remembering and recalling the

present objects (Dorsch, 2015). Memory and imagination both have the potential for developing ideas. Memory indicates an experience of lived conditions and imagination connects itself to beliefs, desires, sensory perceptions, emotions, etc. Therefore, imagination combines new episodic and sensory events from the materials coming from the memory.

Sartre (1940) argues the differences between perception and imagination from a phenomenological perspective. He mentions perceptual consciousness which is shaped by images that are related to objects in the real world. In imagining, similar to perception, images become visible in the mind but with the uncertainty of the forms, materials and stability (Flynn, 1975). Like the Humean approach as vivacity, memory and perceptions are the mind's stable cognitive systems. According to Sartre (1940), imagination presents its objects in four different forms; not present, absent, existing elsewhere, or changed (as cited in Flynn, 1975). Perception and memory are related to present objects or lived experiences and differ from imagination by their presence in the external world. Internal and external conditions that give direction to memory, imagination and perception have the same source of knowledge; the mind itself. Whether it characterizes representations in images or not, mental images that are produced in the mind in a novel way place imagination as a medium. The medium obscures its borders between memory and perception; because it has sensory modalities, uncertain percepts and consciousness of thought.

Novelty, which is the determinant factor of imagination, unlike memory and perception, will be examined in the next section within the term “creativity”. However, the originality and transcendence of imagination can be discussed with combinatorial behavior through the source of memory. Despite the views of pioneering philosophers throughout history, modern views and taxonomies have also been explored to define the scope and use of imagination within the philosophy of mind. These taxonomies are leading sources for examining the features of imagination according to memory and mind. Before looking through features and taxonomies, cognitive systems related to imagination should be evaluated. Cognitive architecture that is discussed with imagination consists of mental entities such as belief, desire, mental imagery, memory and supposition. In that manner, imagination is examined from various sources of human knowledge and related activities (Liao & Gendler, 2020).

As discussed previously, believing and imagining are both described as mental activities. The acts of believing and imagining consist of representations of ideas. In some cases, imagining and believing give the same description with hope. Although there are similarities between them, differentiating properties can be tracked with examples and descriptions. Believing resembles and represents the attitude that people take something as true (Schwitzgebel, 2019). With that description, it can be said that imagining and believing differ from each other in the case of whether the object is true or not. For example, when it is said, "I believe there is a room behind the door", the reality of the subject can be analyzed through sensory experiences. But when one says, "I imagine there is a room behind the door", the subject becomes a personal attribution with other emotions and senses. In that case, imagination differs from believing in the case of aiming for the truth. Furthermore, believing is taken as an action-generating entity because it is related to truth. However, imagination also generates actions but in a sensory way because it is related to emotions and desire-like thoughts. People tend to imagine something different from their experienced senses, they try to create novel and personal representations combined with their true senses and experiences (Sinhababu, 2016).

Desire is evaluated as the attitude that the intended things create in the mind. Desire represents the required world matching the mind, likewise, believing represents the mind matching the true world (Liao & Gendler, 2020). When we examine the relationship between the terms "desire" and "believe", we can reach the concept of desire-like imagination. Currie & Ravenscroft (2002) open up the term desire-like imagination, which combines imagination with emotional responses. Imageries that are connected to desires are motivated by emotions and senses of the desired event. For example, when one desires to have a garden in front of the house, one tends to develop imaginings and experiences related to emotions. Desire-like imagination can be tested by whether the representational content of the imagined event or object is real (Currie & Ravenscroft, 2002). For instance, desiring a garden in front of the house is not actual but, the objects of the representation are related to the real world as explained with the description of the term "desire". In that case, imagination related to desire can be defined by emotions and experiences that are not real in the representation of the mind.

Representational content of imagination can be defined with mental imagery (Kind, 2005). The question of what we imagine shows the content of representations that are shaped as mental images. In the description of imagination, the ability to form images and ideas in the mind also describes mental imagery. But can mental imagery be something else rather than imaginative content? The thought mechanisms and imagery can be discussed with this question. A mental image can be defined as a perception-like sense activated by something rather than external effects. That means mental images can be a picture in mind, an auditory object, a smell or a taste of the content, experiences with feelings, a tune in the head of the thinker, etc. (Vendler, 1984). Mental images can be formed in mind with any of the sensory modalities. Therefore, imagination and its representational content related to sensory and imagistic forms can be discussed in the context of mental imagery. However, according to the aforementioned philosophers, mental images were considered an act and object of imagination with visual properties. Besides the historical views on mental imagery in imagination, Kendall Walton (1990) opposes the theory by arguing there can be imagination without images. But the point here is not whether imagination is expressed in images, but how it is represented in our minds. Imagining a room with a balcony can be represented in different layouts such as visuals in the mind with the combinations of the knowledge of our memory, or the feeling of the wind coming from the balcony to the room. Additionally, an imagined room with a balcony can be formed with different visual aspects such as the sizes of the room, placement of the balcony, coloring, etc. These aspects can be multiplied with other sensory modalities with perception. The representational content that the mental imagery, in that case, shows the endlessness of the mind with the combinational behavior of imagination. Perception, knowledge and experiences of the imagining person give the context of the imageries. That hybrid content of the propositional and sensory imagery shapes the novel ideas (Langland-Hassan, 2015). In that manner, memory, perception, belief, desire, mental imagery and imagination are discussed in the framework of cognitive architecture which is connected with different properties. Nevertheless, imagination establishes its definition with features that differ from other cognitive activities and takes its place in the thought system with the examples given.

As mentioned before, taxonomies about imagination come from similarities and differences through cognitive activities. Imagination and its related properties differ

according to discussions in philosophy, aesthetics, psychology, cognition, etc. Kendall Walton (1990) comes up with the controversies through three opposite paired forms of imagination concerning other cognitive abilities. Imaginings can be "spontaneous and deliberate" according to the property of having conscious actions or not with the level of vivacity coming from beliefs, desires and perceptions. One can decide to imagine something through the present situation, or one can find his/herself imagining random things without any control. The vivacity of the imagined events can change according to consciousness level through these forms of imagination, but in fact, there is no sharp border between them. Because both forms of imagination are combined in the ability of imaginative experience, and they can transform into each other due to the realization of the imagining activity.

Imagining due to consciousness is discussed with the forms in "occurrent and non-occurrent" (Walton, 1990). Imagination activity can be traced as an experience chain starting with occurrent one to non-occurrent. It can be explained with the example of desiring a large house. When one occurrently imagines having a large house, one continuously develops new imagining on the back of his mind and shapes the content of the experienced event. Memory and the knowledge of the imaginer transform the occurrent and non-occurrent imaginings to each other. The duration and consciousness play a decisive role in this formation of imagination. The final definition and distinction of Walton (1990) are between "solitary and social" imaginings. In that case, people personally have a role as imaginers, but also the event of imagining can become a social activity that is developing imaginative content collectively (Walton, 1990). In that manner, deliberate imaginings are bonded to each other to decide on something. Although these taxonomies examined by Walton seem to be dissociated, they describe imagination as a process in unity with its transforming and developing features.

Although Walton classifies imagination with the properties of consciousness, Gregory Currie and Ian Ravenscroft (2002) make a classification of how imagination is formed. Creative, "sensory and recreative" imagination deal with the property of being an ability of the mind. In that case, creative imagination describes an entity of synthesizing ideas and images in a novel way. Creativity and its relation to imagination will be discussed in the next section in a detailed way. In sensory imagination, perception and its relation to the absence of the experiences that are coming to mind is the main approach. Sensory imagination refers to phenomenology and contrasts with

propositional mental actions. To understand the distinction between sensory and propositional modality, some phenomenologists describe sensory as an experience with the visual or aural mode of thinking and propositional –"imagining that"- as certain thoughts which do not involve imagery experiences (Jansen & Kelly, 2014). The central importance of their distinction and description is questioned through imagination's relation to perception and representation. Although Currie and Ravenscroft (2002) discussed imagination in creativity, they emphasize sensory imagination in phenomenology with sensory modes of the mind which are related to emotions, senses and also memory. But in fact, sensory modes of the mind are constructed from the same cognitive system. Memory depends on the past and the present, imagination builds up the present and future within the properties of sensory modes and experiences through one's knowledge.

The other form of imagination described by Currie and Ravenscroft (2002) is recreative imagination. It is also associated with memory, as it is regarded as the ability to generate ideas about the world that differ from current experiences. Thence, it is both about perception and memory in a way and combined with sensory and creative abilities to form mental experiences in novel content. The real events or experiences in mind would be a simulation of the present perceptions. It also can be determined as a remembering activity of the mind considering the relationship with memory. But in the framework of imaginative thinking, recreative imagination involves the imageries of the experienced event without forming full recreations of it but shaped with simulations (Currie & Ravenscroft, 2002). Remembering involves episodic memories that are represented in a certain way (Langland-Hassan, 2020). Although they both have imageries of past events, when imagination is considered a creative ability, imageries may have deficiencies or excesses depending on the episodic memories and can be changed according to present mental conditions. In this case, sensory and creative imaginings may have a role in the ability to recreate images and ideas in mind.

Similar to Ravenscroft and Currie's ideas on imagination, Neil Van Leeuwen (2013) discusses the case with the terms "constructive, attitude and imagistic". Constructive imagining refers to creativity, attitude imagining refers to propositions, and imagistic imagining refers to sensory mental representations. The important point of that current approach is to see what imagination has a role in human action. According to Leeuwen (2013), imagistic imagining has the potential to involve bodily movement motivated

by the senses and percepts that are shaping the imaginative content. Attitude imagining takes its motivation from the desires and pretense of the mimetic experiences. And for the last, constructive imagining deals with the representations and related actions of possible scenarios in the mind that are activated by the choices of the imaginer (Leeuwen, 2013). In that case, action generation in the presence of other cognitive notions can be tracked in imaginative thinking. Although it is thought that imagination is not included in the action-generating system in previous studies, considering that Leeuwen's imagination is related to other systems, it can be seen that it has a structure that is both activating and nourished by actions.

If we look at imagination from a broader perspective, Anna Abraham (2016) classifies imagination according to the relationships established with other actions in her article titled Imaginative Mind with a psychological approach. She starts to analyze imagination from the most comprehensive perspective that is outlined by Leslie Stevenson. Stevenson (2003) describes 12 distinct ways of use for imagination. These 12 conceptions are attributed to the person and have various meanings. Accordingly, "thinking of not perceived things, thinking about possible situations, thinking of belief, thinking of fiction, creating images in the mind, thinking about non-rational things, forming perceptual beliefs, appreciating aesthetic things, creating works of art and creating works with deep meaning" are considered abilities offered by imagination (**Figure 2.3**).

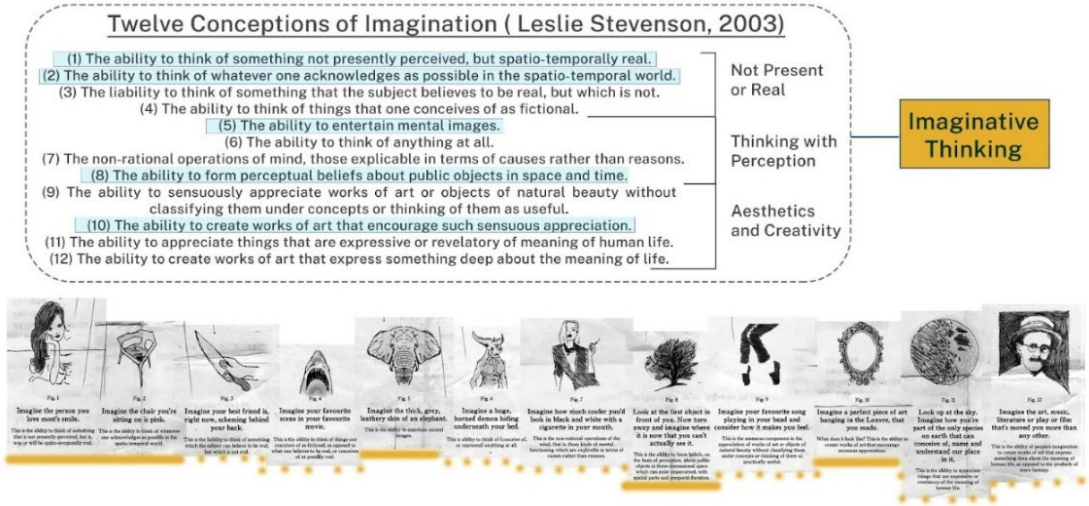

Figure 2.3 : Twelve conceptions of imagination (Stevenson, 2003).

For Abraham (2016), these classifications are considered a whole for the operational part of the processing framework of the mind. To understand imagination as a whole,

the network of creative features is discussed in five different types of imagination. These are classified as "mental imagery-based, intentionality-based, novel combinatorial based, phenomenology based and altered states of imagination" (Abraham, 2016). Examining this classification with its general features helps to question these relationships once again. With this approach, Abraham (2016) has matched this classification with the features they contain as follows:

"Imagery-based imagination" deals with perceptual and motor domains of the neural notions. In that case, perceptions and imageries work as a whole in the mental representation state of imaginative content. Rather than being in a visual mode of thinking, imagery is taken as a whole sensual system of the motor domains of the brain.

"Intentionality-based imagination" represents the recollective and social part of imaginative thought. The recollective approach of imagination is discussed with autobiographical and episodic memory. They explain the processing of future thinking throughout the relationship between memory and imagination with the intentionally triggered knowledge.

"Novel combinatorial-based imagination" depends on creative, generative and counterfactual thought. Works of art and aesthetics explained by Stevenson are also included in Abraham's novel and imaginative thinking process. However, when it comes to creating art and aesthetics, imagination is not explained by ex nihilo, which is defined as coming from nothing. It is always discussed as the reintegration of already present materials of the knowledge.

"Phenomenology-based imagination" engages with the property of aesthetics similar to novel imagination. The phenomenology of imagination focuses on emotions and sensual matters that are responsible for aesthetic appreciation.

"Altered states of imagination" are the final category of the imaginative thinking process and it includes unconscious ways of thinking such as dreaming, hallucinations, delusions, etc. (Abraham, 2016). These kinds of imagination are seen as more challenging to search for.

In summary, it is seen that imagination has been defined in various ways throughout history and there are still debates on it. It is thought that the lack of a precise definition and scope enables imagination to open the door to an unlimited world of thought. As a result of the research on the studies on imagination, the thesis establishes its model.

The thesis model, like Currie and Ravenscroft and later Leeuwen's work on imagination, focuses on and is structured by the relationship between imagination and memory, experience and emotions, movement and change, and thus the creativity that emerges in the production of what has not been experienced before - in other words, new or novel ideas- with the approach of the imaginer. Theories from various disciplines have been employed to investigate the expansion of imagination and the concepts it meets. As a result, the thesis examines imagination in the context of four main functions; associative, iterative, experiential and transformative (**Figure 2.4**). In the following section of the thesis, it will be explained how the relationship between imaginative thinking and creativity is included in the design through these focuses. However, it is thought that the existence and meaning of imagination in design thinking establishes a new model by taking support from the definitions mentioned and at the same time differentiating from them. For this, first of all, it is necessary to investigate the structure of the design process and how the four imagination functions are included in the process.

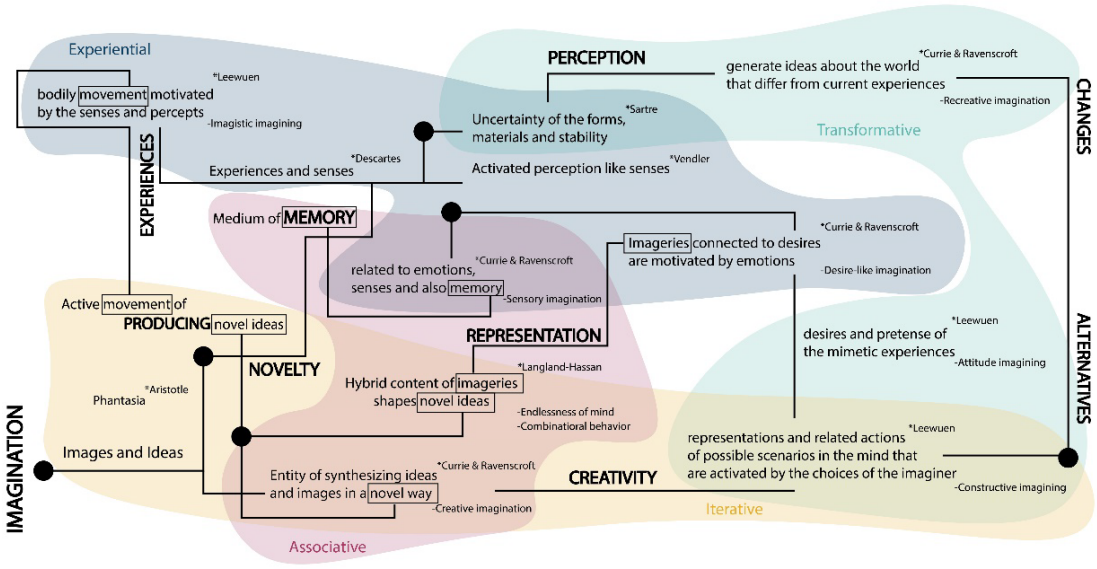

Figure 2.4 : Scope of imagination (Adıgüzel, 2022).

2.2 From Imaginative Thinking to Creativity

As mentioned before, imagination is examined with the ability to create novel images and ideas in mind. According to Kant's Critique of Pure Reason (1787/1999), imagination is discussed in the artistic usages of creativity related to aesthetics. Imagination is discussed as a representation of not-present objects, whether they are

sensible or non-sensible, produced by intuitive activities. In that manner, aesthetics is discussed as the aim of imaginative actions with one's engagement in "free-play" (as cited in Kneller, 2007). At first, the aesthetic understanding of Kant must be examined to see the approach through creativity shaped by imagination. Kant's (1787/1999) account of aesthetic understanding starts with the idea of "Genius" which means the productivity of the artist with working rules through the artwork. In that manner, artistic creativity and productivity are built on artistic genius which is explained as an engagement between aesthetics and originality coming from an individual's mind (Kneller, 2007). This production of the creative mind and imaginative thinking develops the representation of the aesthetic idea. According to Kant, the aesthetic idea appears in the light of certain concepts, with the direction of the creator, that is, with the free use of imagination, the scope of the concept expands, and a new aesthetic idea emerges (as cited in Matherne, 2016). In this case, imagination constructs its representation depending on the concepts. The aesthetic idea builds itself through the combinations and synthesis of knowledge. Thus, the relationship of the associative function of imagination with creativity and concepts can be determined through the aesthetic idea. But in fact, the use of creativity and imagination may change within other factors related to both the mental and exterior worlds of the artist.

With an approach other than aesthetic ideas, Sartre (1940) combines imagination with daily activities, as Stokes (2016) mentioned in his paper "Imagination and Creativity". For Sartre (1940), the creative power of the mind represents itself in producing mental images with conscious activity. For example, reading a novel and appreciating the aesthetic work is considered a creative act as mental representations are maintained. According to Sartre (1940), freedom relies on our mind with the help of imagination, because there are several ways to experience the world we live in and create according to ideas we develop with our imagination. The creative activity to perceive the world and change it with imagination is an individual faculty bound to the presence of the senses (Koukouti & Malafouris, 2020). Therefore, imagination can be discussed in the form of creating new perceptions, experiences and objects in the mind, which is in bilateral dialogue with daily activities. The creating activity resolves itself with the relationship with memory, knowledge, perception, and other cognitive activities but shows itself with different ranges and varieties due to the intention of using imagination (Kind, 2016).

The reproductive and productive imagination that is discussed by Kant also guides the idea of Ravenscroft and Currie's (2002) creative and recreative imagination. Recreative imagination refers to memory and its combinatorial behavior, separating from creativity. Moreover, creativity is described as "the ability to produce or use original and unusual ideas" according to Cambridge Dictionary. The faculty of producing ideas refers to the ability of imagination, but in this case, productivity is not the only critical point. Although synonymous with creativity, originality and unusualness give direction to the term imagination. But in fact, there are disagreements about the relationship between creativity and imagination. Kant argues that creative activities are possible with imagination aiming at aesthetics (Kneller, 2007). Opposite to that argument, Gaut (2003) and Stokes (2014) defend the idea of creativity not involving imagination or imaginings that are not creative. It can be understood that Gaut and Stokes's ideas on imagination also recall the ideas of Sartre. Because they signify imagination from a mental ability to everyday actions with the creative power of the mind. From scientific problem solving to daily thoughts on the consequences of an action, imagination resolves in the mind of the imaginer with its representational content of not present materials. Understanding the involvement of imagination in creativity or creativity in imagination will be discussed from a child's creative development to an adult's design act with the term creative imagination.

According to Vygotsky (2004), creativity is related to any action that depends on the creation of new, whether it is a physical object or a mental experience that is constructed by the person. However, reproductive activity is linked to memory which is the ability to recall and repeat past experiences in the mind. When imagination is engaged with the function of memory, mental images of past experiences dissolve and then come together in different combinatorial ways. Vygotsky (2004) defines this path as the mechanism of creative imagination. So, the creative process starts with the early phase of life. The child accumulates the experiences and deconstructs them to the senses and materials of the knowledge. The process continues with the dissociation of the already existing materials through the experiences of the imaginer (Vygotsky, 2004). This phase defines the set of knowledge of the imaginer. Furthermore, when the experiences or the knowledge set is complex and wide, the creative power of the imaginer becomes to have more potential to use them as novel combinatorial content. However, in this manner, the creation of past experiences is not seen as important as

the creation of novel content. It is important to note that, exaggeration and minimization of experiences have significance for the development of children's imagination. Because creativity and imagination are considered a whole in a case where the elements are disassociated and, in the end, associated in a novel way.

According to Ribot (1906), the novelty and productivity of creative imagination hold their potential on emotions and feelings by dismantling real experiences. In that case, reality comes into the discussion. When the child imagines entering a fantasy world with a magical atmosphere while playing, it is not coming from real experiences. But the disassociation and the recombination of the elements are considered creative acts in the manner of imagining in a novel content. With this approach to creating novelty, children's make-and-believe (Walton, 1990) and the free play activities indicate the borders of creative imagination with the intention to create narrations to make a linkage through reality. The works done to improve the creativity of children are based on the bridge between reality and imagination and the activities, and it is used as a framework for understanding adults' usage of their imagination for creative works.

Besides children's developmental process on creativity, adults have a similar manner with children's imaginative content. However, they differ from each other in the phase of motivation from escaping reality. Contrary to children's imagination, adults have more potential to use the materials of their minds according to their wideness of experiences, but they tend to link the combinations and reality to comfort themselves (Vygotsky, 2004). The voluntariness of imaginative thinking also occurs in the active creativity defined by Gaut (2003). The intentional state of the imaginer gives content to active creativity and imagination becomes the vehicle for creating the potential of future thinking. Voluntariness also describes a path to the non-truth boundness which is related to reality in a way (Stokes, 2014). Imagination and creativity in the discussion of both development of children and adults' activities, take as a basis voluntariness on stripping from reality and experimenting to produce the new. While the use of memory elements as they are does not define imagination, not all productions of the mind define creativity. In this case, creative imagination is considered the production of new contents, objects, and experiences by stripping from reality with the elements brought by memory and attributing value to them.

The creative ability that is consumed by imagination has been used in daily life for a variety of purposes. At this point, it is possible to say that whether creativity is innate

or not, imagination has a structure that triggers creativity and also works together with creative thinking. Due to the production-oriented nature of both, imagination in design thinking can be considered a motivation for creativity. As mentioned before, aesthetics and the creation of art deal with the concept of the 'design' term (Folkmann, 2013). The design act has the potential of creating new alternatives for the future with the values that are produced with the intentional behavior. Combinations of the materials recalled by the memory for novel products are the most important aim of creative imagination in design thinking. According to Kind and Kung (2016), creating new perceptions and alternative future scenarios relate to the transcendent use of imagination. Imaginative thinking related to creativity observes the conceptual phase of design thinking with features such as "vividness, originality, and transformative ability" (Jankowska & Karwowski, 2015). In this case, aiming for originality in imagination is also the most important case of creativity in design. Because the value of the ideas can be measured by the originality/novelty factor and strengthened by alternatives that are created by imagination's broadness. Consequently, design thinking and design process have the potential to use creativity to the fullest. The vividness of ideas comes to the fore in the relationship of imagination with representations. No matter how clear images are obtained, it seems possible to elaborate the design and renew it creatively, and alternatively. The transformative power of imagination in its relationship with representations will also be discussed in the next section. However, within the framework where imagination is used creatively, it is thought that the content of imagination is open to change and the possibility of mental movement.

As mentioned in the introduction, Folkmann's (2010) discussion of the dialogic character of imagination refers to its role in design process. At the intersection of creativity and design, distinct functions of imagination establish different stages of the design process. In this context, it can be observed that the creative features of imagination in daily life are included in design thinking, not only in the design process but also in the activities of the designers that create a dialogue that offers alternative solutions and problem-solving. The functions determined by considering the relationship of imagination with creativity and design within the framework of the mentioned and discussed issues are detailed in the next section. In this context, imagination will be evaluated at the points where it intersects with creativity rather

than a fragmented and separated ability, and its use in the design process will be discussed.

2.3 Architectural Design and Imagination

2.3.1 Architectural design process

In the thesis, the relation between creativity and design thinking is examined as functions of imagination through the design process by following the actions and representations. The design process is evaluated in this way as a multi-layered phenomenon, which also diversifies the patterns of how the forms of the imaginative content are combined. Imagination and its relation to creativity lead to questioning creative abilities as a multi-layered notion. These layers that work as variables define the creative acts in design process. In this section, the relationship between architectural design and imagination will be examined as a creative design process, and how architectural design processes create an environment for the use of imagination by narrowing the framework with creative acts will be investigated.

Nigel Cross (1990) defines architectural design as an interaction between multiple criteria and requirements to develop novel ideas for solving a design problem. It means that design acts as a medium to develop solutions by constructing interactions between concepts. The in-betweenness in which design thinking exists is shaped by the capabilities and experiences of the designer. This occasion reveals the design process as the act of thinking (Goldschmidt & Weil, 1998). While the design process in architectural design includes different design actions rather than just thinking, it also defines the patterns created by these actions both mentally and externally. Architectural design thinking focuses on ideas generated in the mind and their representation in the external world. To begin with an explanation of the design process, creative thinking should be examined. Dewey (1910) constructs his model of thinking in "How We Think", the pioneering book of his cognitive studies. According to Dewey's model of the creative process, novel problem solving is the main issue for generating thoughts. This theory, which Dewey built on education and thinking, is handled in the context of creativity with the idea of novel problem-solving. To approach problems with novel ideas, five phases of the process are structured by Dewey (1910). In this model, the process starts with perceiving the issue and then defining it to solve the whole problem structure. When the problem is defined,

alternative or possible solutions are developed to deal with the problem. For the other phases, these solutions are detailed and reach a certain level. In addition, they are tested to see whether they are efficient for the problem and further examinations are made (Dewey, 1910). However, this structure explains how the thinking process occurs when confronted with a problem; creativity and its role in the design process are not mentioned in the model. Although Dewey distinguishes imagination and the thought system, he associates imagination with creativity and attributes it to experiences and knowledge for creating novel solutions.

In addition to Dewey's model, Wallas (1926) described a process that is among the most well-known models of the creative process. This model describes stages starting from preparation to incubation, illumination and ending with verification. The preparation phase is the analysis part of the process which consists of collecting information and coding them to build a schema for the problem. The mind is made open and free for all possible ideas during the incubation stage. The creative act manifests itself as the sudden generation of the solution during the illumination phase. Intuition and perception open up the possibilities for creative thinking, and the verification stage tests the originality and efficiency of the ideas generated (Wallas, 1926). Although Wallas's staged creative thinking model provides a basis for later models, it shows that this process is shaped by different inputs and activities in current discussions (**Figure 2.5**).

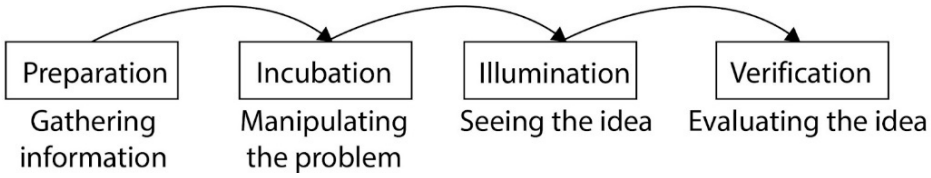

Figure 2.5 : Wallas's Model fo creativity (1926).

In his book, "The Act of Creation", Koestler (1964) deconstructs creativity and the related process and focuses on the associative aspect of creativity. With this model, Koestler (1964) associates the term "bisociation" with past experiences or knowledge and defines the thought system as two intersecting planes. It suggests that the creative thinking process takes place at the point where the information on two planes is related to each other with references (**Figure 2.6**). The established pattern provides the term bisociation by reading it through matrices with independent characters and activities (Koestler, 1964). This shows that the design process has evolved into creativity with

novel thinking, which is formed by bringing together independent references. Guilford's model, proposed in 1967, provides a process with divergent and convergent thinking. With this approach, a designer is thought to be a “box”, including intelligence with mental processes, content and product. Similar to Koestler's definition of creativity, in this model, creativity is enriched by multiple inputs and targets the product. Beyond this, thinking of the designer's mind as a box has led to the development of the definitions of “black box” and “glass box” as creative design processes (Jones, 1970). With black box approach, creativity and the design idea can be found in the mind of the designer but nowhere else. This situation leads design process as a mystery of the designer’s approach that can not be analyzed (Jones, 1970). In Osborn's (1953) book “Applied Imagination”, some design methods that include the activities to create ideas begin to take place throughout the process, including the randomness of the black box approach. In this book, the creative thinking technique; brainstorming which is the effort on finding a list of ideas spontaneously is introduced and creative forms of imagination involved in the process are determined. In 1961, In addition to brainstorming, Gordon put forward the synectics method, so that creativity is considered a goal in the design process. The process in which sinectics is involved is supported by analogies to create different ways of thinking rather than intensifying the act of thinking. He characterizes creativity as the field of forging new connections by developing representations to describe the solution. By the approach of black box designers, the creative design process started to be considered a design method with these techniques and actions, and the processes were considered within this intuitiveness (Gordon, 1961).

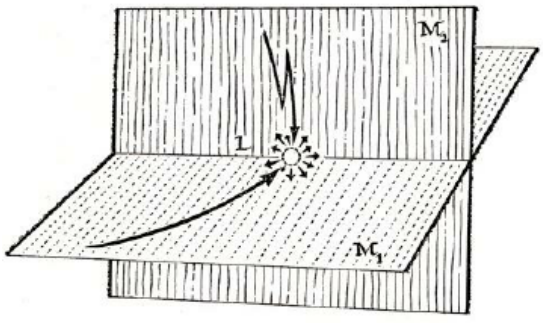

Figure 2.6 : Koestler’s bisociation model (1964).

Unlike the black box, with the glass box approach, design is seen as a systematic process within logical and rational perspective (Jones, 1970). The systematic design

processes proposed by Jones and Thornley at the Conference on Design Methods (1963) referred to Zwicky's Morphological Method (1948) and led him to consider design as a problem-solving activity. Asimow (1962) explains this systematic model with the stages of the design process, which he defines as analysis, synthesis, and evaluation. The design product is tested and developed for specific purposes during this process, so that the design is refined as an approach towards the optimum solution rather than being novel. With the glass-box approach, design process is considered with paths and stages linked with design methods and techniques within a systematic flow or a loop through solving the problem (Archer, 1968).

According to Horst Rittel (1973), architectural design problems are wicked problems that do not have definite formulations and therefore do not have definite solutions, and the outcome is uncertain. These problems can be defined in the design and solution process as problems that have uncertain stages, have multiple stages, or have alternative solutions and results. Working with such problems in design thinking can be considered a factor that paves the way for innovative thoughts, differentiates from engineering problems and increases production with a creative approach. With this point of view, the inclusion of heuristic processes in design is inevitable as it works with alternative options and progresses with cognitive movements back and forth to find shortcuts to make decisions (Uluoğlu, 2020). Participatory practices in design can be given as examples of argumentation-based approaches and heuristic design. In a process where the user is involved in the design process and the production process of the product, the design reveals itself as a diagram. Certain patterns, solution options and uses are presented to the user are handled with a heuristic approach (Turner, 1976, Habraken, 1972). Beyond the theories that specifically target participation, Alexander's (1977) Pattern Language book defines a design process that permits a heuristic approach. It provides architectural elements and patterns as a basis and offers quick alternative solutions to problems. The diagrammatic definition of the heuristic approach also represents the decision-making activities in design process as it is dealt with both mental and external faculties.

Beyond the argumentation-based generation of the heuristic approach, artificial intelligence studies that deal with design as information processing and cognition have led to the diversification of studies on the design process focusing on problem-solving. In his study on problem-solving, Burns (2000) sets out from the three components that

Newell and Simon (1972) discussed problem space. According to this study, the components that make up the research are described as a problem, situations that transform the problem, and a test for the solution. However, in addition to these, Burns (2000) also mentions current discussions and offers a wide scope of problem-solving approaches with "dual-space" search (induction plus problem-solving) and "understanding" process (concluding understanding as a search material). As a result of his protocol analysis and studies on this subject, Eastman (1970) redefines the design process as a cycle in which alternatives can be reevaluated rather than a systematically divided process. With this thought, Eastman focused on the relationship between the concrete and the abstract in the design process, the unity of the past and the new, and the directing of limitations, with the inferences he made as a result of the data. Ömer Akın (1978) creates information processing sets based on the work of Newell and Simon. This system, which can be defined as a mechanism, can be considered design actions, as well as defining the designer's knowledge-memory and representation-architecture relationship. With Akın's works, information processing and architectural design process studies are differentiated as a structure where critical decisions and precedents are formed, rather than a gradual setup.

Furthermore, Schön (1983) developed a new model for revealing the cognitive processes of the designers. The model includes three different actions: "knowing in action", "reflection in action" and "reflection on action" (**Figure 2.7**).

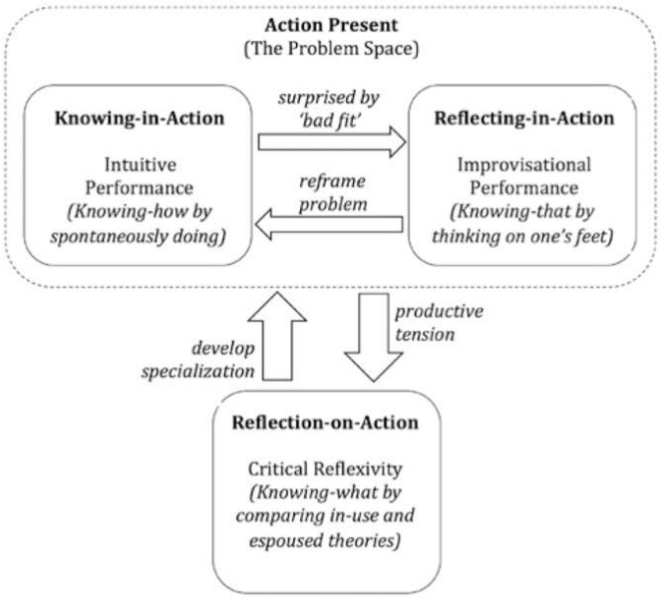

Figure 2.7 : Schön's Reflective Practice (Malinin, 2018).

> Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action (Schön, 1983, p. 49.).

> Reflecting-in-action. If common sense recognizes knowing-in-action, it also recognizes that we sometimes think about what we are doing. Phrases like 'thinking on your feet," "keeping your wits about you," and "learning by doing" suggest not only that we can think about doing but that we can think about doing something while doing it. Some of the most interesting examples of this process occur in the midst of a performance (Schön, 1983, p. 54.).

By explaining the processes with the term “action”, he manages to show the design process as an embodied notion (Malinin, 2018). During the design process, the body and the environment work as a whole and the actions establish the design idea concerning the information they receive from each other. In this case, it can be interpreted that the way to the solution in design is provided by the reflection of the inferences that emerge as a new way of thinking. The logic of the design processes that Schön describes has the potential to use actions as representations of the designed solution. In 1997, Cross put forward the idea of four staged design processes: exploration, generation, evaluation, and communication within the framework of problem-focused activities. The first stage in this model shapes the problem definition and also defines the path to the solution. Therefore with the generation stage, the designer generates alternative design solutions with minor transformations and also radical changes. The evaluation stage tests the solutions for the design problem and concludes with the manipulations through it. The last stage, which is communication, is the stage where the other three stages connect and the solution to the problem is concluded. In this case, Nigel Cross (2013) approaches design thinking by explaining mental processes as their interaction with external representation:

> Design intelligence involves an intense, reflective interaction with representations of problems and solutions, and an ability to shift easily and rapidly between concrete representations and abstract thought, between doing and thinking (Cross, 2013, p.72).

Statement of the verb “doing” indicates the route taken from the problem to the solution dealt with the design actions where thinking is considered as the mental process. The act of doing can be considered as the reflection of the act of thinking in external representation, and the transitions between them constitute the design process. The think-aloud sessions while designing a solution to a problem lead to understanding what designers think and do, and how they switch the representation tools from mental

to external. According to Bryan Lawson's (1980) model on design process, there are some focusing actions related to design thinking which are concentrated as "formulating, moving, 'representing, evaluating and reflecting". This approach also focuses on design problem and design solution and describes sequences of actions which are perceived as a whole design process. In this manner, Lawson (1980) defines these actions related to imagination when it considered in the concept of representation. Furthermore, these actions and their related subactions do not gives a certain limit or path but defines the possibilities of design approaches. Similar to Lawson's model (1980), in the thesis, actions are considered as the outcome of imagination and this approach makes design process dynamic.

According to Goldschmidt and Porter (2004), the design process is built upon the urge to develop a satisfying representation of the designed entity with the designer's activities, both mental and external:

> In the process of generating, developing, and assessing ideas, one reason about them; the designer or design team inspects ideas and images, sources of inspiration, partial solutions, and so on to ensure their relevancy, their congruence with requirements and constraints, and their "good fit" with one another (Goldschmidt & Porter, 2004, p.204).

This statement reveals the design process by detecting the design tools; ideas and images. As mentioned before, ideas and images are the content of imagination as they are mentally produced. The ideas and images represented as concepts in design thinking also portray the need for external representation, in other words, externalization compensates for the limitations of inner/cognitive representations (Goldschmidt & Porter, 2004). Furthermore, design thinking is considered not only with the process and the mental content, but it also includes the design tools and representational methods that are used to express the design idea with various actions.

Oxman (1994) states that the representation of design knowledge consists of chunks of design stories. Both the old precedent of the design content and the newly developed design precedents have a network of stories that make the process meaningful. The uniqueness of the precedents indicates the conceptual design content annotated by the stories (Oxman, 1994). Furthermore, it can be said that, while there are various types of representation of design content, the design process can be represented with the linkages and the networks through the memory and imagination content. The creativity over the networks and linkages are the main issue for tracking imagination by the

representational content and the design activities. By this approach, design activity and its related representation models through the design process reveal the imaginative content with its functions and novelty.

Akın and Lin (1995) approach the design process and the representation of it with an activity-based model. With verbal and visual protocol analysis, examining, drawing and thinking are taken as design activities during the design process (**Figure 2.8**). The conclusions of the study indicate and describe the novel design decisions within the activities taken variously. However, both verbal and visual representations of the design process show the shifts through design activities. Novel design decisions vary in the process with their uniqueness to the designer (Akın & Lin, 1995). The activities according to Akın's analysis determine the design process with both mental and external, or verbal and visual. In this manner, the representation of the process also reveals the presentation media of the designed object/space. Imagination in this term shows itself as the novel design decision stages. Design activities express the design process with the representational content of imagination. Because imagination consists of the ideas developed in the mental world but has a dialogue with the external world.

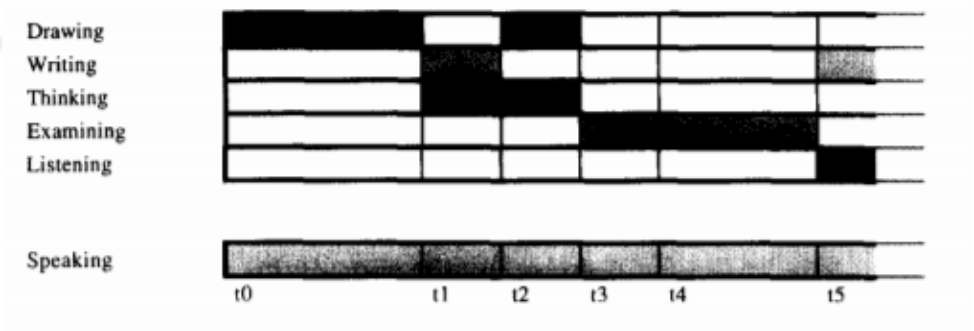

Figure 2.8 : Activity-based model (Akın & Lin, 1995).

The design process advocated by the thesis appears as a process supported by multiple inputs and internal and external factors and is examined as a phenomenon that establishes a dialogue under the control of imagination with its layered structure. These inputs, which are examined in the context of design thinking, are accepted as the basis of design decisions and are established through design actions in the stages of understanding, creating and developing the design. Imagination motivates and triggered by the behaviorus of the designer as it is discussed with the theory of Leeuwen in the previous section. These behaviors form itself as the actions taken during the design process as shown in **Figure 2.9** (Leeuwen, 2011). As these actions

are out of order, designer conducts her/his pattern with sub-actions and representations through imagination.

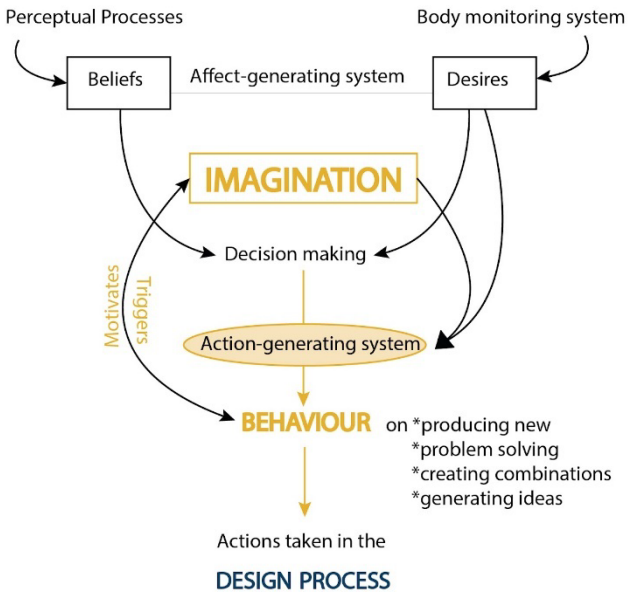

Figure 2.9 : Leeuwen's (2011) description of imagination (Adıgüzel, 2022).

Beyond the aforementioned design research and theories, studies are examined on a wide scale, from discussions on form and language, cognitive psychology, unconscious states, precedent knowledge, unrepresented knowledge, and abstract and concrete relations. However, the design process does not present specific design stages, while the representation and actions provided by imagination are seen as the effect that establishes the process. As a result, the design process is diversified with different inputs and outputs as well as common patterns. At this point, creativity takes place in the design process with the production of new and original design solutions and decisions and plays a role in the differentiation of the process. On the other hand, imagination establishes both common patterns and common behavior groups in the design process and nurtures the process in mutual interaction with creativity and its functions which are investigated as associative, iterative, experiential and transformative. Furthermore, the thesis focuses on the representational content of novel design decisions by revealing the design activities that are developed by the functions of imagination. By this approach, functions of imagination that are explained in the next section also show the design actions represented through different phases of the process. Although the functions of imagination are contextualized separately in design thinking, their enriching positions are not ignored by the thesis. These functions

should be considered a network of design representation and the key factor for novel design decisions. Mapping of the design process by revealing imagination with its functions shows the design activities that consist in mental and external representation media. In the next section, the functions of imagination through the different actions of the design process will be examined to understand the relations of both creativity and design representations (**Figure 2.10**).

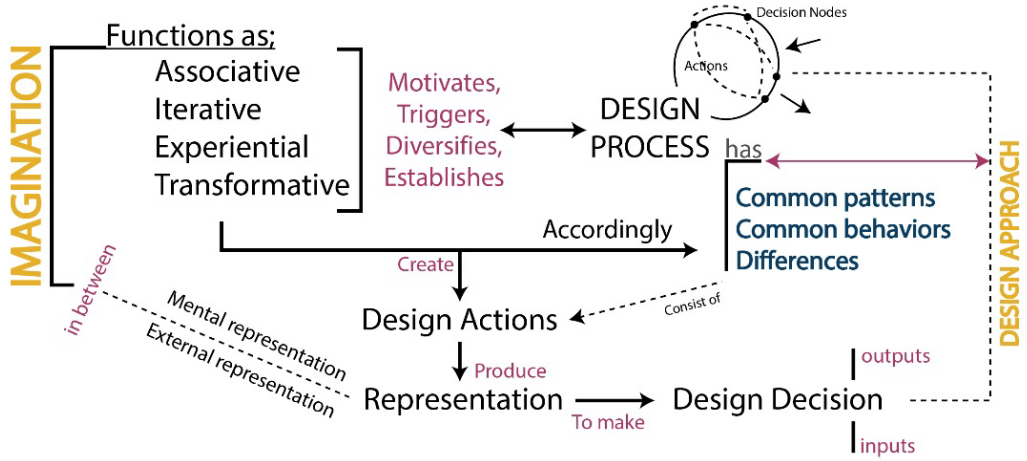

Figure 2.10 : Design process related to imagination (Adıgüzel, 2022).

2.3.2 Functions of imagination

As mentioned in previous sections, imagination is built into human thought through different uses. It is possible to categorize imagination by focusing on its different functions and uses, as in Anna Abraham's approach, which treats it as a categorization that works integrated with all its functions. This classification should not be considered separately, but as a mixed approach process supported by the ability to generate ideas. In this context, imagination is examined with its associative, iterative, experiential and transformative functions within the scope of the thesis. While these features and functions can be used together, they also reveal the existence of imagination separately. While the functions of imagination, on which the act of thinking focuses and concentrates, determine the content of imagination, the forms in which they are represented are also discussed.

In this context, it seems possible to follow imagination through these functions in design process. Looking at the nature of the design, it establishes a causal link and orientation between the old and the new (Folkmann, 2013). However, the nature of the creative act also nurtures design. As discussed in the previous section, imagination

related to creativity uses mind as a tool to produce novel ideas. Imagination positions itself as a dialogic element and processes it with other cognitive actions of the mind such as memory, perception, etc. (Hollway, 2011). The spread of creativity in daily life shows that it is also included in the approach to design problems. In this context, the dialogue-forming function of imagination is differentiated from other functions and assumes an all-encompassing role rather than a discrete feature. The dialogue established is made possible by the dialogue-forming function of imagination between mutual binaries such as physical and mental, abstract and concrete, reality and fantasy, passive and active, concept and form (**Figure 2.11**). The scope of the design process is also determined by the limits that imagination puts on new possibilities for solutions. Dewey (2005) defines imagination as making sense of thought and structuring a process for creating novel content. The interpretation here can be read with the value and effectiveness of the dialogue established. The stance of imagination, which differs from other cognitive states and establishes this dialogue, is possible by taking it as a whole and expanding its scope.

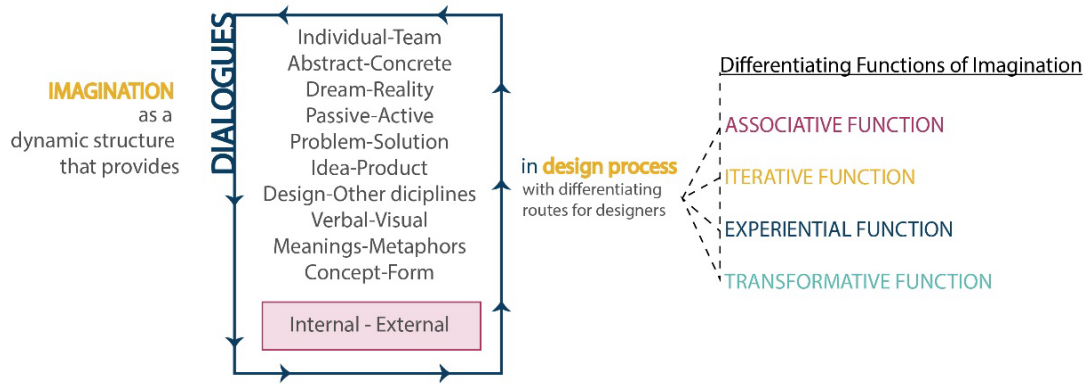

Figure 2.11 : Dialogues provided by imagination (Adıgüzel, 2022).

2.3.2.1 Associative function of imagination

Before proceeding to design representation, it is necessary to explain how functions of imagination specified in design thinking manifest themselves. The associative function sets up its scope over the productions based on combinations and relations. According to Kant's (1787/1999) definition, imagination has a synthetic function that allows it to combine and shape new representations based on the subjects' experiences (Haag, 2013). In this context, imagination as a creative ability enables the gathering of information by establishing relationships with memory. However, although each new experience and object that is brought together do not have a creative feature, it is not

enough to define the individual boundaries of imagination. While the synthetic function serves to bring together separated, analyzed, and categorized information, this gathering takes place as a conceptual stage in the design process. The approach held against the design problem allows developing concepts to make sense of the idea by relating it to memory. Although these concepts function as the rules that the mind provides for the solution of the design problem, they also cause the formation of design patterns. In this context, imagination reveals its synthesizing function while presenting a new idea with the information given in the design. To understand this process, it is investigated to bring together the problems and information given in the design process together with past experiences. The material here can be an idea, or it is seen as a new product within the scope of representation tools. As mentioned before, the creativity level of the product can be analyzed with criteria such as vividness, transformative ability, and originality. Beyond the past experiences and the information brought by the problem, the creation of a new reality construct as a result of synthesis and association also reveals the effect of imagination. In this manner, the associative function of imagination deals with terms, memory, and concept.

Association between memory and imagination is defined as one of the major points of constructing space in the mind. Gaston Bachelard (1969) explains the relationship among them by the term "poetic image". Before concluding the architectural design process, he draws a path for determining the space as a synthesis of memory and imagination:

> The house, like fire and water, will permit me, later in this work, to recall flashes of daydreams that illuminate the synthesis of immemorial and recollected. In this remote region, memory and imagination remain associated, each one working for their mutual deepening. In the order of values, they both constitute a community of memory and image (Bachelard, 1969, p.5).

Through those sentences, recalling the memories and immemorial thoughts of imagination give a route from past to future. This association comes from the poetic image, different from the real image and constructed by the power of imagination that engraves the memories for future experiences. In his book Thinking Architecture, Peter Zumthor (2010) portrays his memories experienced in his aunt's house and tries to emphasize his architectural design understanding of his past. He defines memory as a "reservoir" for creating architectural design within its atmosphere, images, and materiality. The fragments and the experiences of the memory transform into a new

atmosphere within the associative function of imagination. Furthermore, Juhanni Pallasmaa (2014) defines memory as a base of imagination. Besides the experiences and the fragments of knowledge, archetypes of architectural design define imagination and its associative function. Pallasmaa (2014) continues his definition of imagination by emphasizing archetypal thinking which deals with Bachelard's (1969) term "primal image". He defines architecture and its related elements with primal images such as materiality, structure, geometry, etc. The associations of the experiences and composition of the articulated space become the objects of the associative function of imagination. Furthermore, Viollet le Duc, gives an example of the synthesizing factor of active imagination with the man in a horse, in a different word "centaur" and then he merges the Gothic architecture with novel restoration ideas as a syntax of creative imagination with the memory consist in "*Dictionarrie*" (Vinegar, 1998) (**Figure 2.12**).

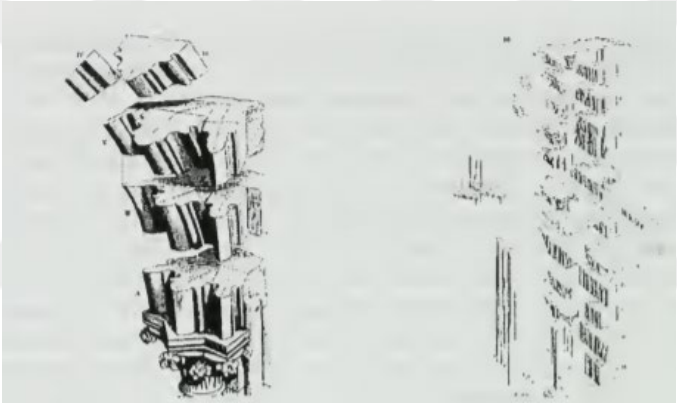

Figure 2.12 : The exploded views of a vault springing and a portion of a nave wall construction from Notre Dame at Dijon (Vinegar, 1998).

Imagination defined in "Dictionarrie" relies on the novel drawing techniques used as the triggering factor for the design process. As can be seen in history, the archetypal approach or the relations with ancient architecture are examples of associating the old and new with the work of imagination. But in that manner, memory is separated into two distinct categories; the first one is the experiences and fragments of the designer, and the second is the knowledge of the architectural space. In both cases, if imagination works as an associator, it differentiates itself from pure memory and creates an approach for developing a novel design process.

Imagination uses the associative function to produce designs with conceptual thinking in architecture, apart from its relationship with memory. Eilouti (2018) defines the conceptual design process as the stage at which the design concept is generated by

integrating it with various sources, which he classifies as analogy, metaphor, theme, scenario, context, scheme, and symbolism. Related sources show how architectural design becomes a conceptual syntax through meaning. According to Frascari (2011), metaphors are more than a language and their related meaning through thought, it is a base of the understanding and the development of the architectural design. Ayıran (2012) gives an example of using a metaphor for creating an architectural design approach with Joseph Paxton's Cyrstal Palace (**Figure 2.13**). He uses metaphors as conceptual themes taken from natural elements to create structural patterns and architectural inspiration. It can be understood that the metaphors appear as new interpretations that come together with architectural design. In that case, imagination takes a role as a associator with the relationship established between different concepts.

Figure 2.13 : Crystal Palace by Joseph Paxton and the picture depicting the strength of water lily leaves carrying Paxton's daughter (Ayıran, 2012).

The spatial and architectural design decisions also carry the meanings of the concept with analogies. The description of the designed space and the relations established through the process can be tracked with the analogies, and also with the metaphors that work as analogies. Both analogy and metaphoric representation media can be used as verbal and visual representations and help to crystallize ideas by combining the spatial design approach with different inputs in architectural imagination (Usal &Evcil, 2017). In that manner, drawings with analogies and metaphors showing the semantic relations in the conceptualization process of design thinking should be considered the footprint of imagination. For instance, Jorn Utzon uses the "cloud" metaphor as a "ceiling" to enhance the idea of the light materials or the transparency in his drawing of Bagsvaerd Community Church as shown in **Figure 2.14** (Schank Smith, 2008). Although Steven Holl uses some words on the drawings with analogic definitions

(**Figure 2.15**) to relate the materiality of the Museum and the properties of the human body to create the concept of "building as body" (Schank Smith, 2008). By those examples and definitions, the concept development phase of the design process consists of the associative function of imagination that relies on combining ideas and their meanings with a creative approach. The likeness and the relationship with different concepts are the main associative factor for conceptualizing architectural design with novel content.

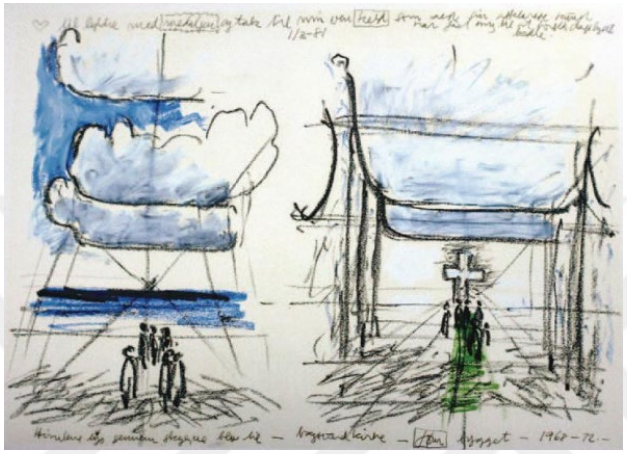

Figure 2.14 : Jørn Utzon; Bagsvaerd Community Church (Schank Smith, 2008).

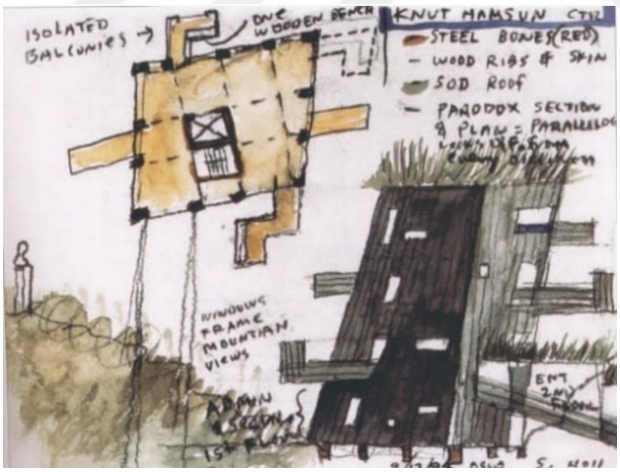

Figure 2.15 : Steven Holl; Knut Hamsun Museum (Schank Smith, 2008).

Therefore, the associative function of imagination interacts with the memory of the designer, enabling new combinations with experience and information, establishing associations for the design problem with various sources, and getting involved in conceptual design thinking to ensure the continuity of the cause-and-effect relationship (**Figure 2.16**).

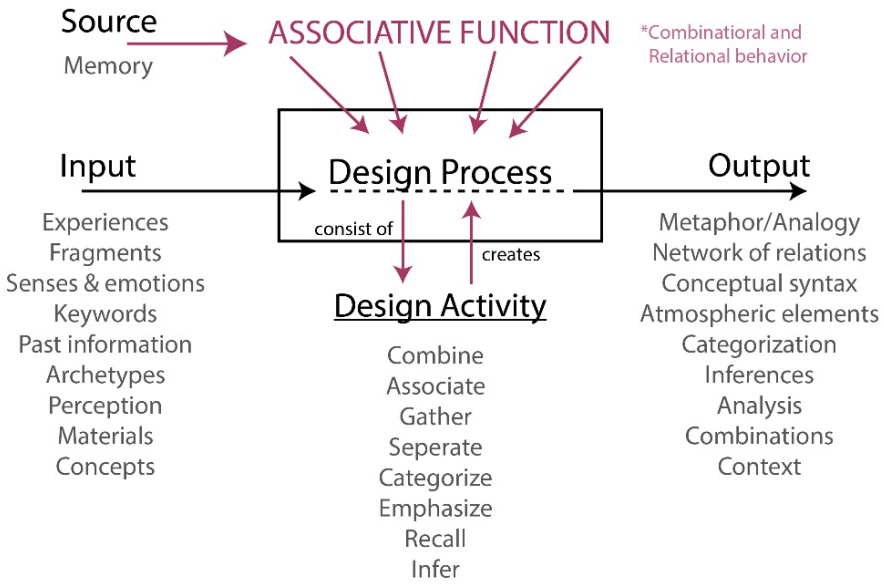

Figure 2.16 : Associative function of imagination in design process (Adıgüzel, 2022).

2.3.2.2 Iterative function of imagination

Although the iterative function of imagination is understood as a combination with the associative function, it bases its main scope on the ability to produce ideas with alternated representations and alternated approaches. The ability to produce alternatives to problems reveals the development of imagination. According to Byrne (2007), the function of imagination that causes stripping from reality is associated with the tendency to produce an alternative. The free play of the mind and the effort to create a better representation of reality always exist within the infinite content of imagination (Byrne, 2007). In the design process, it is seen as an inevitable series of steps to produce by trial and error and to develop the design accordingly. The multiplicity of this process is possible with the diversification of the design product. In this context, imagination acquires an iterative role by changing the representations it produces or establishing completely new meanings as a creative act. While the design process can be defined as a making process in which different approaches, representations and techniques are used together, design thinking is repeated with these differences. Imagination is included in design thinking with the potential created by these differences. Transitions between design decisions and established relationships allow imagination to create an iterative production in the design process. The production potential is also related to the creative imagination that Currie and

Ravenscroft (2002) put forward. The reproduction of the creative potential associated with representation in design and the re-interpretation of the mind as a design tool defines the iterative function of imagination. In the dialogue between the design problem and its solution, imagination enables multiple paths to be determined and the established meanings and relationships to be strengthened. The search for this function in the design process can be questioned with the representation methods used and the design processes produced by differentiating from each other through the abstract to concrete design ideas. While considering this subject within the framework of architecture, Uluoğlu (1996) emphasizes this relationship and states that the communication between the student and the instructor in architectural design teaching is on the bridge built with abstract and concrete discourses. She states that this situation is achieved by transitions from abstract to concrete, from concrete to abstract in the criticisms given to the student, and that these repetitions are necessary in design thinking, as is the necessity of the relationship between thinking and doing (Uluoğlu, 1996). At this point, it is understood that the function of imagination that provides repetitive production also plays an active role in the communication established on the idea of design. Furthermore, this communication is constructed upon the features of iterative function since it also represents the relationship between abstract and concrete design thought and reveals that imagination is a constantly working mechanism through design process. Imagination, which is known to be associated with various cognitive functions, enables solutions to be diversified by increasing these relationships. Beyond the correctness of the solution offered against the problem, each new step that is taken towards the definitive decisions of the designer is a potential design and comes into existence in alternatives with the iterative function of imagination. In that case, imagination, and its iterative function work in the manner of creating alternatives through the abstract to concrete with different design approaches.

Iterative function of imagination gains a creative identity by introducing repetitive and differentiating approaches to the generation of new ideas. In architectural design, this situation can be sought with the capacity to produce alternative solutions and the description of the produced design from abstract to concrete. Furthermore, the first approach to understanding the iterative function of imagination is searching for the process of abstract to concrete in design thinking. In this case, a representation of the design decision comes into existence for enhancing the idea of thinking with abstract

and concrete notions. According to Vidler (2000), diagrammatic representations are the main source of architectural abstraction to perceive design decisions imaginatively. He gives examples of Le Corbusier's work on lines and forms for creating a new sensation through the representational act (**Figure 2.17**). Besides its symbolic purpose, abstraction of the materials, senses, feelings, and spatiality can be seen as a creative power to transform objects into another existence. This existence also represents the identity and the creativity of the designer.

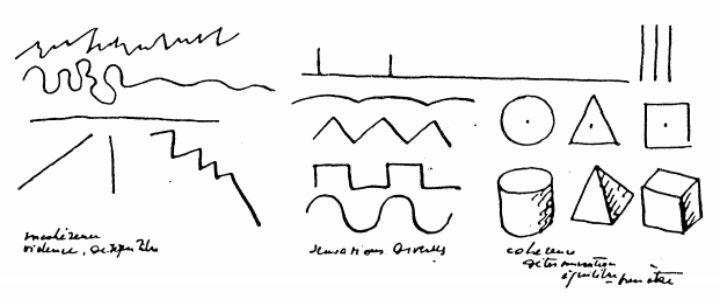

Figure 2.17 : Le Corbusier, "Diagram of lines and forms as they affect the physiology of sensations" (Vidler, 2000).

The iterative function of imagination acts as an associative function as well in case the idea combines reality with abstracted ideas. Beyond that, imagination seeks novel creation through the design process. Architectural design and its abstractness are constructed on form, organization, elements, and linkages of the lived experiences (Telang, 2005). The ability to transform something into a new abstract entity is seen as a beginning point of the creative design process with the help of iterative function of imagination. Furthermore, the design solution's transformation from the abstract to the concrete is also the focusing point of the iterative function. In this case, tectonics and material imagining become the important topics to discuss. Novel content in architectural imagination with iterative function is the process of transforming abstract design into concrete decisions. In Steven Holl's diagrammatic plan scheme of Cactus Towers (**Figure 2.18**), Live Work Lofts, materiality and scales can be read as concrete design decisions. But in the other drawing, the imagined materiality begins to be apparent as it takes the shape in the mind of Holl (Schank Smith, 2008). In both drawings, we can understand the abstraction and the tectonic design decisions used to enhance the architectural design. A novel idea in the case of Holl is the trials on the materiality and the atmosphere through the abstracted representations. But in fact; in the Petronas Tower drawing (**Figure 2.19**), the abstractness of the senses over the

building also represents the concrete design decision that shapes the architectural perception (Schank Smith, 2008). As a result, generating design ideas with abstract thinking in order to develop concrete design decisions is seen as the main function of imagination in architectural design.

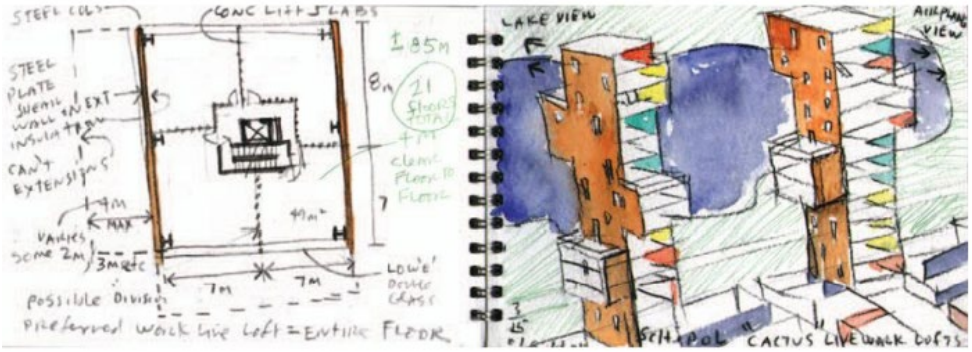

Figure 2.18 : Steven Holl, Cactus Towers. (Schank Smith, 2008).

Figure 2.19 : Cesar Pelli; Petronas Towers (Schank Smith, 2008).

Productivity through architectural design process can be searched with the novel alternative design solutions created. This function and its subcase also define the design process and the conceptualization phase. Conceptualization can be used in architectural design processes, creative problem-solving, inferring and relating something in daily life and creating alternatives for reality. In this case, utopias are considered as the decisive productions for which novelty is aimed. According to Hartmann's (2009) dissertation, creating alternatives in the design process helps to understand the design problem and multiplies the decision options to use it more effectively. In this case, representations and tools that are used in the design process define the limits of the possibility of creating alternatives. For instance, Frei Otto’s

trials with varied materials and techniques over the model-making process define an endless way of creating alternatives (**Figure 2.20**). Because he sees the design process as an experiment through architectural practice.

Figure 2.20 : Frei Otto's models in the exhibition (Url-1).

The urge to develop novel ideas through model-making leads to a variety of design solutions. Furthermore, this urge can be tracked through basic sketches too. Reima Pietila's drawings as sections and plans (**Figure 2.21**) show the possible design alternatives through the design process (Schank Smith, 2008). Slight differences in the drawings indicate the testing phase of the designed area. Design alternatives also comprise a process from abstract to concrete. Imagination helps to initiate in designers' cognitive world to form ideas, internalizes design solutions and enables to develop the idea with different approaches from different perspectives. In this case representation of the designed space indicates the organization, form, geometry, or experiences with a variety of possibilities (Schank Smith, 2008).

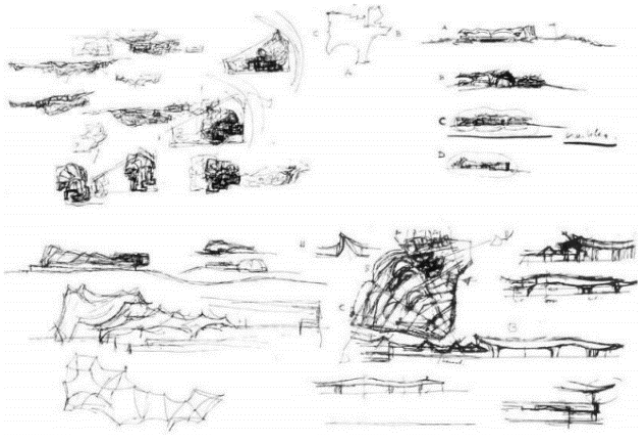

Figure 2.21 : Reima Pietilä; Dipoli Student Assembly Building, Ontaniemi, Espoo (Schank Smith, 2008).

Iterative function of imagination with the approach of creating alternatives works as a tool to expand the creativity of the designer. From this point of view, the use of diversified design tools and methods and the drive to develop the most efficient design solutions enrich imagination by producing alternatives. Moreover, design tools that are used in juxtaposition through the process help to develop the idea more creatively since it enables the designer's mind to work in multiple approaches. According to Goldschmidt (1991), evaluating the space being designed with various sketches, prototypes or any other type of representation increases the creativity of the design process. Also, he defines the design process as transitions through different representation modes as an iterative ability of the mind to assess and try new possibilities. This embodiment to produce novel things from abstract to concrete or from different approaches through the design process is generated by imagination's iterative function (**Figure 2.22**).

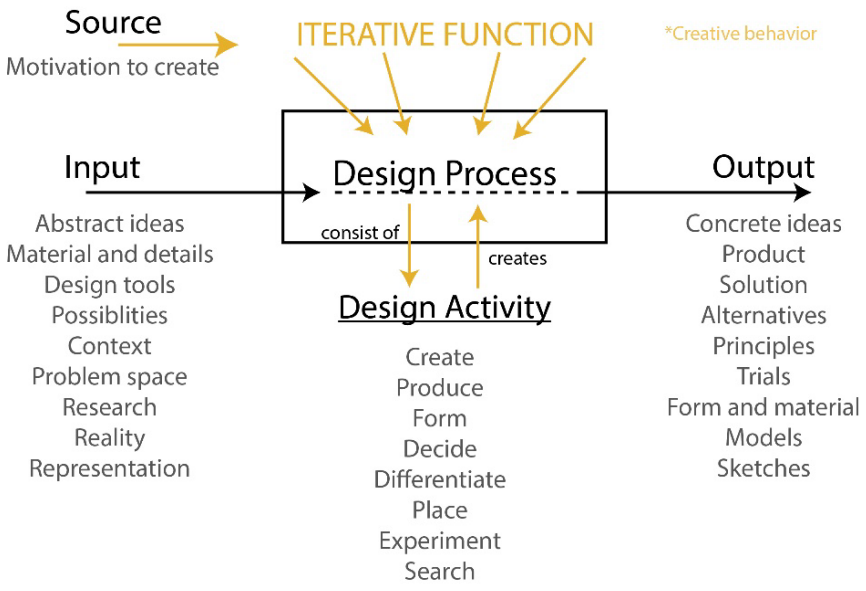

Figure 2.22 : Iterative function of imagination in design process (Adıgüzel, 2022).

2.3.2.3 Experiential function of imagination

Imagination, whose relationship with sensory memory was mentioned in the previous sections with associative function, gains the experiential function by targeting the experiences, emotions, perceptions and senses come together. The fact that each material in the memory and each element synthesized by imagination are based on the experiences of the individuals, shows that the resulting product also has an experience-

oriented feature as can be related to architectural solutions. However, in discussions about the representation of imagination, it is questioned whether the mind works only with visuals or other inputs. Imagination processed by perception at this stage includes intangible concepts such as experiences, senses and emotions beyond visual representational objects. Considering that the associative function is fed from past experiences, the emotions, feelings, and perceptions carried by the experiences also play a role in the production of new knowledge. It is thought that past experiences are fragmented, and a process/flow is defined by filling in the gaps between them. In this context, it is understood that imagination fills the visual and sensory gap in the act of remembering and presents a continuous perception (Zittoun & Cerchia, 2013). In the design process, it is seen that imagination is used in the creation of objects or spaces by filling between past experiences and establishing a relationship with the new problem. Design thinking, fed by processes of narrating such as story or scenario production, reveals the experiential function of imagination. With this process, which ensures the establishment of a continuous perception, imagination creates a new alternative by establishing a connection with reality. Physically, the mind can feel itself in the experience produced by imagination with practices such as make-believe or role-playing. The purpose of design for producing experiences enriches creativity. Material elements are brought together under the influence of feelings, emotions and the immaterial (Folkmann, 2013). It becomes continuous with the dialogue established between the fragments. This continuity is possible thanks to imagination generating new perceptions from experiences as a creative force and combining it with the immaterial ones.

Narrative thinking in architectural design is dealt with by various theorists. Chatman (1975) defines narratives with two main cases: story and discourse. The stories consist of characters, events, and details; discourse consists of the network and the manifestation of the called stories. The linkage and the network defined here are also mentioned by Roland Barthes (1975), as the narratives are unique and connected by the structures. In this manner, architectural design thinking involves such a structure to deal with a spatial problem. Since the architectural design focuses on the spatial activities and the subjects living in, the experiential faculty of imagination relies on the experiences and the narrations that may be created over the design problem. Zumthor (2010) describes the narrative act over his design process with the example

of filmmaking. The sequences that form the film with the eye of the camera also relate to the architect who is designing a building with the flow of visuals and descriptions. The focusing point of the narratives in architectural design can be the time factor. The design problem can be dealt with as an ongoing process of living space since it describes a narration with its subjects, actions, details, and relations. Constructing the narrative structure is the conclusion of the experiential function of imagination. Although Frascari (2011) highlights the importance of narrative creativity for improving the design solutions with different storytelling approaches such as drawings perceived with "imaginary points" (**Figure 2.23**).

Figure 2.23 : Architectural storytelling (Frascari, 2011).

If the techniques and tools used to represent the idea of architectural content have the potential to narrate the designed space, it is more helpful and perceivable to deal with the experiences that will happen (Ampatzidou, 2014). For example, perspective drawings or sequential fragments with the manner of representing the space using living layers and details, narrative acts and storytelling conclude an experiential function of imagination. Bjarke Ingels (2014) talks in the documentary Future of Storytelling (Url-2) about the connection between architectural design and fantasized stories (**Figure 2.24**). Ingels (2014) states architecture as a base for transforming

imagination into the crystalized reality of the stories of the living world by drawing storytelling diagrams.

Figure 2.24 : Bjarke Ingels drawing the Worldcraft (Url-2).

By this approach, diagrams, comics, storyboards, or perspective drawings with living layers represent the storytelling architecture for carrying the imaginative points to reality. Because the motion over the represented design idea can be perceived and evaluated with the stories and discourses structured in the designer's mind. Van Berkel's Moebius House (**Figure 2.25**) represents the idea of changing the environment of the designed space with its movement through the abstract and living layers (Molinari & Bigiotti, 2014). Spatial organization and the elements can be found in the collage as a potential to develop the design idea with new experiential meanings searched through motioned/cinematic visions.

Figure 2.25 : Van Berkel's Moebius House drawing (Molinari & Bigiotti, 2014).

Bachelard (1969) constructs storytelling in our daily life and the environment we live in and defines it as a notion embedded in the space. In this context, reading spaces as

if they were a story brings different meanings and reveals new potentials. In conclusion, the narrative and storytelling architecture represents the space in motion to make a dialogue with reality. Imagination and its experiential function give an identity to the design idea through the expression of subjective production and perspectives.

The experiential function of imagination shows itself with phenomenological representations besides narrative acts. Senses and emotions that build the atmosphere of the designed space also define the ability to experience the idea in mind before its built-in reality. The creative factor of the senses and emotions relies on the idea of being subjective and authentic. Rasmussen (1962) states architectural atmosphere with its sensory properties. These properties portray the effects of material decisions with the relationship between immaterial things such as emotions, senses, feelings, etc. The feeling of the light coming through a crack in the wall carries an atmospheric meaning when it is decided as an architectural idea (**Figure 2.26**). Imagination in this case indicates the ability to think and perceive immaterial things in a medium working with material trials to perceive the space with all the senses and emotions (Mindrup, 2015).

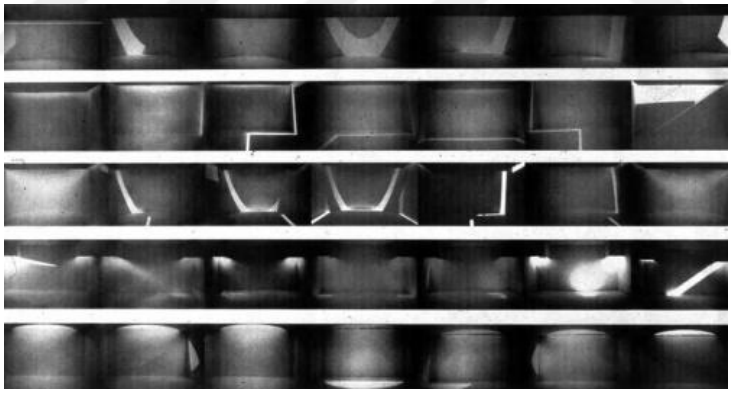

Figure 2.26 : Light studies for the Museum of the City, Cassino, Italy, 1996. (Mindrup, 2015).

The experiential function of imagination builds an interface through the sensual experiences in the design process. Tuan (1930) associates this with the movement. He states that experiences such as kinetics, vision and touch are needed to perceive the space. This shows that the experiences that form the basis of spatial imagination are created by the awareness of these movements Similarly, Relph (1976) argues that space is a phenomenon related to people's experiences rather than a representation of dimensions. According to Relph (1976), these experiences are unlimited and the

continuity from direct experience to abstract thought establishes the possibilities of space. In this case, the possibilities of the space are explained by the experience modes, and in terms of its features, it takes place in daily life with varying densities. In this context, modes of experience discussed within the definitions by Relph (Seamon & Sowers, 2008) are formed with phenomena such as emotion, perception, cognition, and abstractness, and ultimately establish the space through the continuum of daily life. These phenomena that come forward in the design suggest a creative way of thinking using different representation methods. The abstractness of the sensual representations also resembles iterative function of imagination in a way. But in the case of the experience factor, architectural space builds its atmosphere with sensual events. Narrations that are built on architectural designs also consist of senses and emotions to delineate the spatial atmosphere. In this case, delineating factors are the immaterial things built by the materiality of the space through the experiences of atmospheric design. The experiential function of imagination can be seen as the intersection of the other functions. For instance, the immateriality in the design can be the result of the conceptualizing phase and represented as an abstract visual. Furthermore, experiences of the architectural design process with the help of imagination indicate the delineation and the immateriality of the space with the motion and embodied process of perceiving the space in mind (**Figure 2.27**).

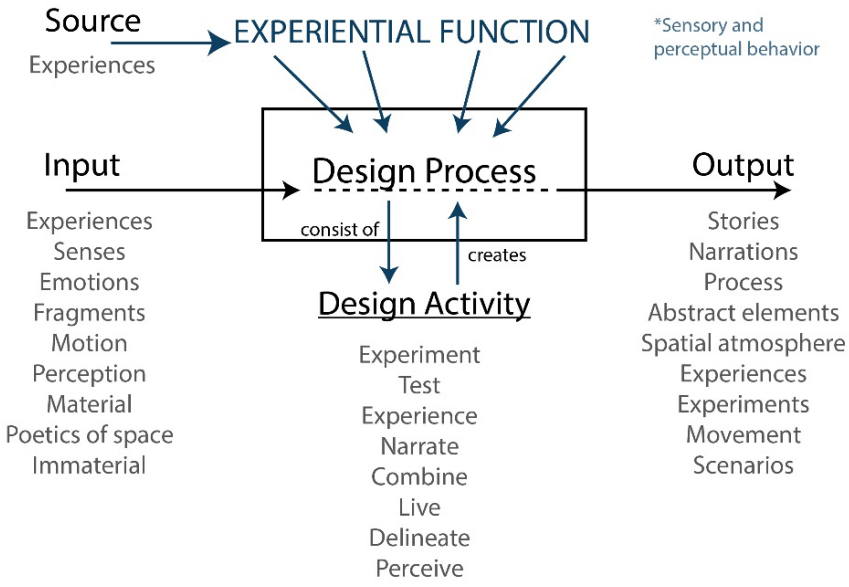

Figure 2.27 : Experiential function of imagination in design process (Adıgüzel, 2022).

2.3.2.4 Transformative function of imagination

Considering the place of imagination in mental representation, each new perspective that is produced re-establishes the representation of the design. The image or analogy projected in mental representation is in a state of constant change and transformation. For instance, moving an object in the mind is seen as an imaginative ability (Thomas, 2021), the representational feature of imagination also triggers other transformation modes of thought systems. In this context, the transformative function of imagination reveals changes in mental representation. As seen in studies on imagination and creativity, the development of motor abilities is tested depending on the operability of transformations in the mind (Thomas, 2021). Mental rotation is one of the processes of imagination that serves to render the invisible parts of the object visible beyond the mentally represented parts. In the framework in which this is considered an ability, mental transformation contains clues for the perception of the representations provided by imagination within the scope of the thesis. When examined within design thinking, these transformations allow for the modification, alteration, rotation, penetration, and a variety of other interventions on the designed product. When looking at the design processes, testing an object or space by drawing from different angles, adding something new, or transforming it at every stage of the drawing is related to the transformative function of imagination beyond producing an alternative. In this context, the mechanisms of representation become the means of imagination. This design process, which can be associated with body-mind coordination, also reveals the dialogue that imagination establishes with the physical world. By this function, imagination reveals the architectural design process with spatial organization and formation.

Ching (2007) defines the systems and orders with the integration of space, form, function, and techniques to create the context of the architectural approach to design by representing the various spatial possibilities that can take action in the process (**Figure 2.28**). The basic elements of the geometries, shapes and orders are the primer step of the design process. Novel creations and productions are seen as the capacity to transform the basic elements accordingly with different approaches. Organization and formation that consist of the transformative function of imagination describe the representational ability that is included in the process as a nodal point in the design for decision-making as a creative act.

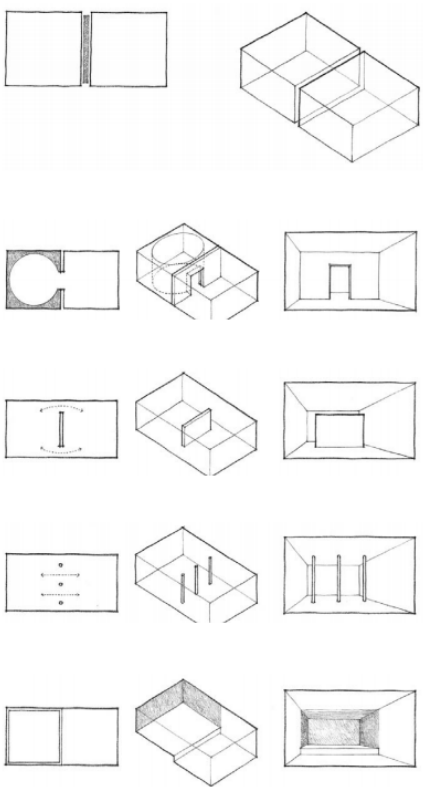

Figure 2.28 : Ching's adjacent space organizations (2007).

Prats (2009) concludes the representational content of the transformation of forms and shapes with experiments on the designer's process of sketching. The formation that can be tracked through sketches or visuals is classified as addition, deletion, modification, or replacement (Prats, 2009). Transformations that are defined with the work of imagination draw a path for perceiving the spatial organization and formation in the design process. In Steven Holl's drawings (**Figure 2.29**), the sections, perspectives, and plans working at the same time present the mental ability of imagination (Url-3). The formation and the organization of the mentally represented object change according to the function of transformative function of imagination. Holl represents and develops his architectural idea by perceiving the space by looking from different angles. In this case, taking a section slice from an axonometric view of the imagined space defines new problems for organizational spatiality. It is seen that in this study, Holl considers the changes in the section and plan as two-dimensional, as well as an eye in the third dimension. The creative situation here is that the form taken as a primer change and transforms with different perceptions. At this point, instead of producing new alternatives, imagination was represented by small manipulations and enabled to transform the design into something new.

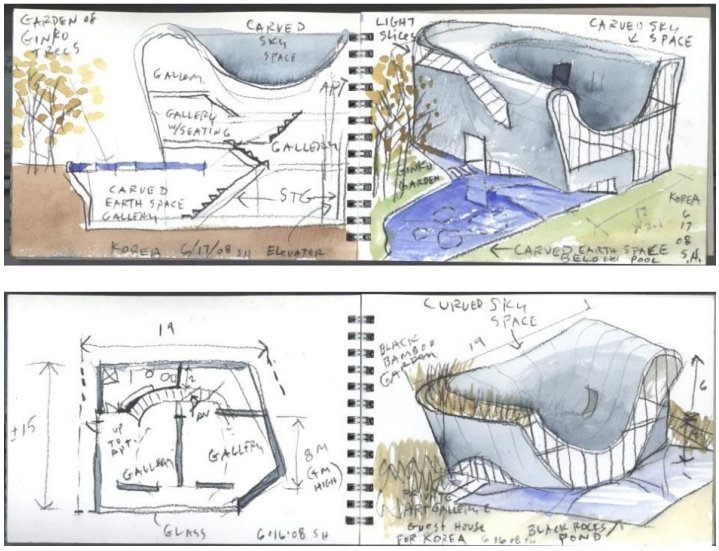

Figure 2.29 : Architects' Sketchbooks: Steven Holl (Url-3).

The primer form of the imagined space gets modified with each step and each sketch that is developed by the rotation of the mental representation. The creativity with this process is the transformation level of the primer form to the end production. But the case is not only the exterior shape or the geometry, it is the spatial organization built through the embodiment of body-mind coordination. While it relates to the design process itself, design methods and cognition expand imagination by referring to evolutionary design systems. Thus, these systems focus on manipulating the design to ensure these designs adapt to their environment (Janssen et al., 2000). This transformation that can be discussed as an evolutionary system in architectural design traces through the design methodology and computational activities of the design solution.

Frazer (1995) introduces the generative-evolutionary approach in "An Evolutionary Architecture". This approach attributes the evolutionary process of nature to architectural design as a productive process. In this context, a metaphorical connection is established between architecture and nature. The connection includes various algorithms, repetitions, transformations, processes, selections, and productions. With a productive-evolutionary approach, the computational-based model is included in the architectural design, and in this way, it develops by adapting to the design environment with various manipulations. Each stage presents a change in which the design evolves, and the change in form reveals the design process and development in coding and algorithm as shown in **Figure 2.30** (Frazer & Janssen, 2003). In this case, transformative function of imagination takes place effectively in design methods as it

is associated with representation. Nodal points that enable decision-making in a design process that evolves from basic shapes or initial design reveal the existence of imagination. Because at that point, imagination represented design and continued its existence in search of creative solutions with manipulation and transformations.

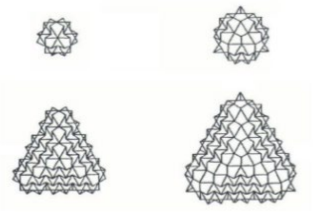

Figure 4: Building forms growing from two different seeds during the epigenetic process.

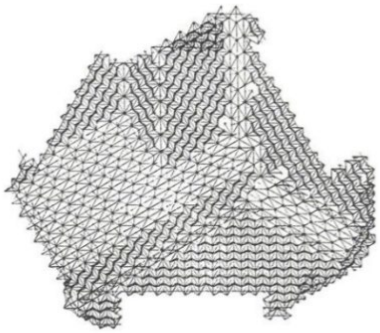

Figure 5: Plan of building generated from star seed.

Figure 2.30 : Creative Evolutionary Systems generative process of forming a building from seeds (Frazer & Janssen, 2003).

Beginning from the primal form and organization, the designer transforms it with insight. Imagination gains its goal of creating novelty and begins to define itself with the desire to perceive the designed space from various perspectives. Form and organization change within almost every phase of the design process. But it becomes a creativity factor when it resolves as an ability to transform something in the mind into novel content with modifications, etc. In his book Sketches of Thought, Goel (1995) deals with the approach to the problem through five topics. Accordingly, it is possible to explain the problem-solving process as lateral and vertical under the title of transformations. While lateral changes provide a different idea by referring to the iterative function of imagination, vertical transformation provides the solution to the problem on the elaboration of a single idea. Problem-solving through sketches and discussion of changes in the approach to the problem also enables us to consider the place of imagination in the creativity and design process. For instance, Daniel

Liebskind (Url-4) and his architectural approach exemplify creativity over the transformation of primal form and organization (**Figure 2.31**). The geometry, depth, scale, form, shape, and even the viewing point of the thought defines the identity of the transformative function of imagination. In this case, it can be seen both lateral and vertical transformations as a creative and imaginative thinking process as it is concluded with a novel idea shaped by transformative sketches.

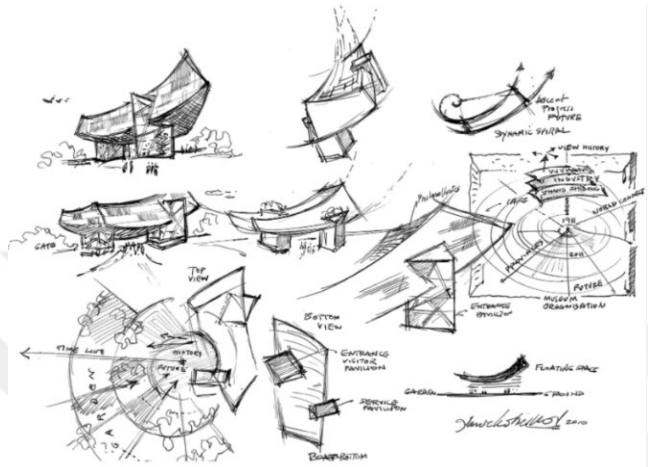

Figure 2.31 : How Architecture Is Born: 7 Poetic Sketches by Daniel Libeskind and the Buildings They Inspired (Url-4).

In each process to develop the 'new' in architectural design, he tries to perceive the whole space with different representations and modifies the form and organization accordingly. In this case, the urge to develop the space by working as rotations in the mind describes the design process as abstracting and manipulating the form. The ability to perceive the designed space from different angles and manipulate it in every representational process can be seen as the transformative function of imagination. Creativity and novelty of the transformative function are the main criteria for the architectural design process as a dialogue in imaginative content. Although developing the design from an abstract geometry to a concrete spatiality is seen as the ability to create novel representations in perceiving architectural ideas.

Apart from computational methods, it is seen that an evolutionary scheme is drawn manually and intuitively. Within this scheme, a structure that changes from general to detailed is followed, and creativity and imagination are sought in representing them together. In this case, imagination has provided the basis for manipulating the space and design by transitioning between different perceptions, and indeed for an understanding from the general to the details. As a conventional understanding, it can

be defined as the representation of the first design idea as a final product by changing and transforming, apart from imagination producing the new. The differentiation of perceptions in the process, the transformation of representations, and the involvement of design manipulations in creativity within an evolutionary scheme reveal the transformative form of imagination (**Figure 2.32**).

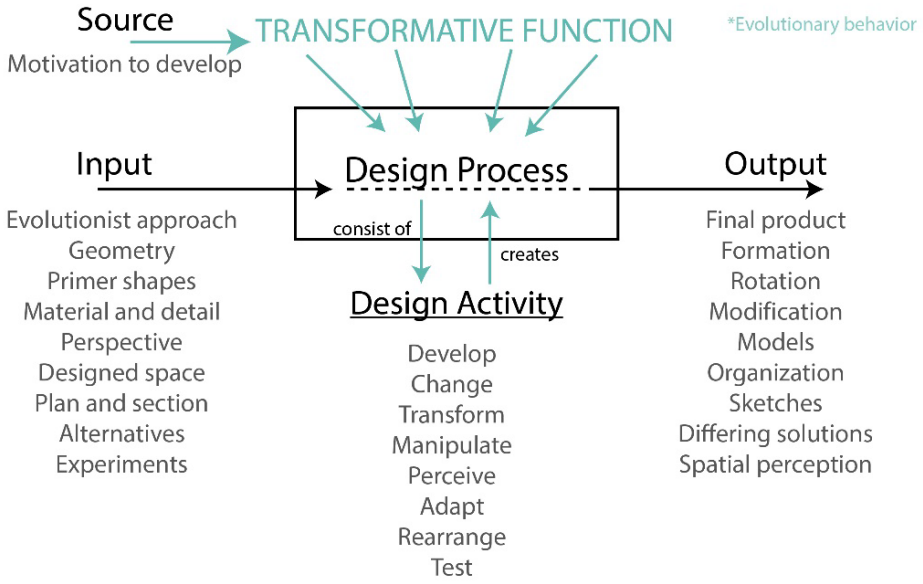

Figure 2.32 : Transformative function of imagination in design process (Adıgüzel, 2022).

2.4 Conclusion: Imagination Overall

In this part of the thesis, as a result of the conceptual and theoretical literature review, the issues related to imagination are discussed, the scope of imagination is determined and the place of the four imagination functions, which form the model of the research, in design thought is revealed. In this context, it can be said that imagination is open to discussion with concepts such as perception, memory, experience, innovation, representation and creativity. Imagination, which is considered a mental and cognitive capacity, enables the realization of various actions with their different forms. Imagination, the intensity and use of which varies within the forms of thought, is considered a skill that continues to exist in the mind. With the thesis study, which will be advanced in the focus of the four imagination functions that have been determined and put forward, the conceptual framework for the relationship between imagination and design thinking is established. However, the situation of producing the new, which

dominates at the intersection with creativity, is thought to define the place of imagination in design thinking. The existence of imagination in the design processes and techniques researched in this section is demonstrated by exemplary with four different functions defined. In this context, it is seen that imagination is involved in design processes in different actions and representations, such as experiential, iterative, associative and transformative. The non-linear and differentiated nature of the design processes with different inputs shows that the functions of imagination also enrich the design in different directions. At the same time, it can be said that imagination plays an inclusive role in the relationship between representation and action when both traditional and digital design techniques are discussed together. According to this, imagination interacts with the representations and actions used in design thinking, and design processes diversify in this context, which is shaped by the features and functions of imagination investigated in the conceptual background.

3. DESIGN REPRESENTATION AND IMAGINATION

In design thinking, imagination takes various forms, which diversifies the design process. Various approaches to the design process contain different inputs and outputs, which are discussed as design methods and design representation. The main question of this section is how imagination is represented and how it relates to design representations at the point where imagination meets creativity and design thinking. Although functions of imagination discussed in the previous chapter describe various methods and processes, the attempt in this chapter is to follow imagination through representational forms. Imagination, which is divided into four functions within the scope of the thesis, is considered a power in the creation of new ideas and in proposing solutions to the design problem. At this point, representation of imagination is associated with actions performed and is included in the design process. In this context, first, the relationship between imagination and representation will be discussed in the context of design thinking. Afterward, representations used in design processes and related actions will be disassembled and the routes created by imagination will be discussed in detail. It can be said that the main purpose of the study and specifically this chapter is to reveal in detail how various representations used in the design process are related to the actions provided by imagination.

Before moving on to the different types of representation in design, how imagination is represented will be discussed. As it is mentioned before, Liao and Gendler (2020) defined imagination as the activity "representing" the possibilities, non-present times, and perspectives rather than reality. Baudrillard (1994) opens the subject of representation in the dichotomy of imaginary and the real. By defining imagination as a simulation of reality, he states that it is a phenomenon that establishes a connection between reality and its meaning. In this manner, the concept of imaginary product, or in this case imagery, takes its meaning from reality and appears as a simulation of reality. Consequently, imagination functions as an action to represent the simulated concept from reality.

Accordingly, imagination can be discussed with the subject of representation. Sartre (1940) investigated the boundaries of imagination through experiments involving the interaction of observer and observation in the mind. The images and the definitions of the imagined representations or the observed things inside the mind refer to the mental imageries that are shaped with the materials derived from memory and perception. Furthermore, representation has blurred notions of the imagined object because it is shaped only by the observers' mental conditions. In contrast to Sartre, Ponty (1945) treats the visible as a reflection of the invisible. He claims that imagination is processed as inclusive both internally and externally and that ideas and meanings are hidden in the invisible. He argues that the thoughts represented physically and mentally enrich each other and that the representation of imagination exists in this mixed relationship. Furthermore, Folkmann (2013) summarizes this dichotomy and makes a connection to design ontology as follows.

> Thus, seen as presence and representation, the imaginary operates at the intersection of the material and the immaterial; or, rather, as a structural component of a phenomenology of the creation and ontology of meaning, the imaginary can be regarded as a vehicle of meaning that mediates material and immaterial; through it, the material meaning becomes immaterial, even as the unrealized meaning remains connected to the material. The imaginary presents a productive challenge to design ontology: It does not promote an ontology-based on solely negated meaning (thus the locus of Sartre's investigation); instead, it underpins a new ontology of design that combines materiality and immateriality, actuality, and possibility (Folkmann, 2013, p.126).

In this case, imagination carries the duty of representing both the object of simulation and the meaning of the represented thought. These representations of imagination in design process build a structure that connects the internal and external. In this section, the representation in the design process will be examined by following the route of the activities that define the structure that contains the invisible and associates it with the visible. Mental representations and related discussions show how imagination is represented in the mind and how representations relate to imaginary products. The binding feature of imagination standing at the intersection of these questions also reveals the relationship between external representation and design. Within the scope of the thesis, imagination is considered an intermediate state between mental and external representation in design approaches and processes. Together with the structure formed by representations, the design is followed by the actions of imagination, which presents both visible things and invisible meanings. For this,

mental representation models and external representations used in design will be examined concerning the actions performed, and their relationship with imagination will be structured within the scope of four defined functions of imagination.

3.1 Mental Representation

As mentioned before, imagination is seen as the capacity to develop mental representations in the absence of stimuli. These representations may be tracked within the knowledge of real-world experiences or perceptions. Imagination is then seen as an intermediate state connecting with the outside world. However, considering imagination as an internal representation is inevitable within the framework of its relationship with other cognitive states as a mental activity. The place of mental representation in psychology and cognition has been the subject of various studies. Mental representation will be investigated with mental models, semantic networks, ontology, and will focus on schema theory. In this context, this section will define the structure of mental representation as well as the characteristics of imagination. How imagination relates to mental representation in the design process will also be followed through these definitions.

3.1.1 Forms and theories of mental representation

Mental representation can be considered a system in which the information contained in the memory and obtained from the outside world is restructured. The subject of mental representation, which includes information processing and its content, takes place in theories directly related to knowledge types. In this case, in order to analyze representation models, it is necessary to first investigate what knowledge is and how it is represented.

With reference to Anderson (1976), knowledge is defined by procedural and declarative processes. The declarative process is defined as the conscious action sequence that initiates knowledge and defines the transition to the procedural process. On the other hand, procedural knowledge is also associated with concepts and supports declarative knowledge (Anderson, 1976). Information that explains how to act within the framework of clear procedures (Anderson, 1976). In this case, procedural information is associated with the "how" question, while declarative information is connected with the "what" question. Accordingly, Uluoğlu (2000) discussed design

knowledge with a structure in the focus of declarative and procedural approach. According to this structure, categories, content, representation and design information are handled in the declarative information set that includes the basic elements of design as object and subject, and the procedural information set that includes actions and experiences (Uluoğlu, 2000). In this context, it has been possible to code the structure of design knowledge with actions containing knowledge sets and to classify the representation formed in studio education with these codes. Consequently, the information produced and contained by the design process and the design itself is represented, and this representation is handled declaratively and procedurally. By processing these binary knowledge types together and creating the aforementioned structure, the designer will be able to support her/his creativity with various references and gain the acquisition of adding qualitative and quantitative information to the design process.

The association of declarative and procedural knowledge with memory explains how imagination is also processed in the mind. The experience-based representation of imagination, which focuses on and envisions the reprocessing and production of knowledge, is associated with mental imagery. In this case, it is necessary to analyze in which environments mental imagery takes place in mind. Contrary to Kant's review on Critique of Pure Reason (1787/1999) about reproductive and productive imagination that describes its relationship with creativity; Vygotsky (2004) justifies the imaginative content related to creativity by describing imagining as combinatorial behavior. The combinations of mental elements are operated by imagination and represented for nurturing creative activity. Imaginative thoughts have an aspect of representational format which can be experienced as mental images and words. Mental images are the sequences of images or events that come from the minds' eye, and the words are the representational format of inner speech with linguistic knowledge (Langland-Hassan & Vicente, 2018). Though, individual differences of correlation between visual and verbal thinking are argued with mental representation theories named as mental imagery debates (Raffaelli, Wilcox, & Andrews-Hanna, 2020).

If the mental imagery is examined in more detail, it is considered a quasi-perceptual experience that includes different perceptions such as "seeing through the mind's eye" and "hearing in the head" as it is discussed before (Thomas, 2014). Ongoing discussions define the form of these perceptions and are treated as analog-proposition

debates or picture-description debates. Beyond declarative and procedural knowledge, it is also possible to define knowledge as analogue and descriptive. In this context, the analogue representation, emphasized by Fodor (1975) and Kosslyn (1980), is defined as a description and pictorialism by processing mental phenomena like a picture (within the framework of the spatial characteristics of the picture). Dennett (1981) and Pylyshyn (1973) advocate the propositional representation differs from analogue in that it does not contain spatial features and includes linguistic definitions. There are linguistic definitions in the form of hearing in the head in mental representations, and thus the verbal equivalent of visuality is sought with descriptions. In this case, both declarative and procedural information can be processed in mind both analogously and descriptively. However, the point to be noted is that; both representational dimensions can process the information contained in mind and make it possible to switch between them. In contrast to singular representation processes, dual-coding theory advocates for the thinking process to be both verbal and visual (Paivio, 1991) (**Figure 3.1**).

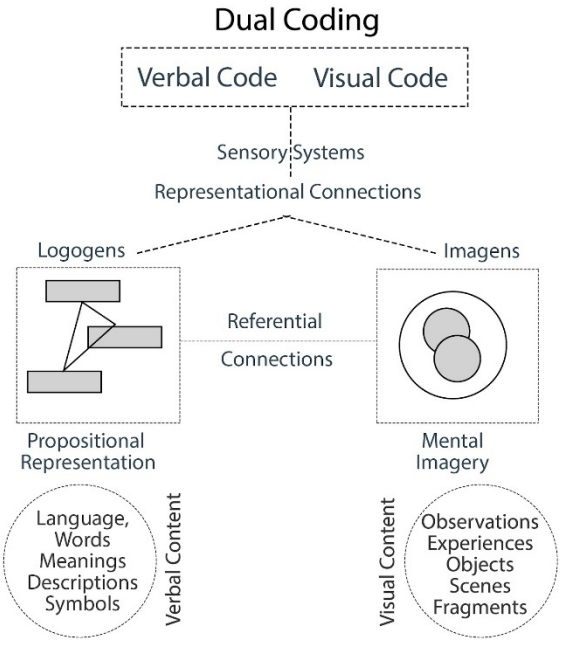

Figure 3.1 : Dual Coding Theory adapted from Paivio (Adıgüzel, 2022).

One of the key contrasts is between concreteness and abstraction, which is akin to the distinction between verbal and visual codes transmitted as mental images and words. Functional and perceptual views through verbal and visual codes give the association of imaginability (Amit, Gottlieb, Greene, 2014). In design thinking, materializing the ideas in the mind is usually perceived as visual. But with the dual-coding process, verbal codes nurture the mental images with their descriptive characteristic, whereas

visual codes nurture the inner speech with its connection to real perceptions (Paivio, 1991). For example, in design thinking, the declarative content of imagining a place contains information about the place's elements, environment, and material. While the representation of declarative knowledge can be a simple geometry (analogue) as a visual image, the description of the elements of the space can be processed as a linguistic description (descriptive) (Paivio, 1991). Likewise, while procedural information can be visualized in sequences, it can also be represented by the verbal representations of various actions. In this case, it is understood that both information and both representations can be used simultaneously.

Similarly, Vendler (1984) removed mental imagery from defining visual code by arguing with examples involving sensory imagery and considered the senses and emotions as the intermediate state of the perception in which the two coexist. Although these examples include imaginings related to the senses such as the roar of a lion, the smell of onions, the warmth of the sun, they can be depicted both visually and verbally, but the enriching point is the sensual notion that can be also called affective images. Considering these examples and definitions of Vendler, it is seen that it is not sufficient to consider the mental image as analogue or descriptive by itself. As mentioned before, the act of imagining is a quasi-perceptual experience involving senses and emotions, and its counterpart in the mind should be read as a versatile and multi-input whole in design thinking. This issue emerges at different stages in the design process and design education. Design thinking, which can be defined as a visual, linguistic and sensory thinking process, reconstructs procedural and declarative information in coordination with memory. Imagination, on the other hand, takes knowledge as content in this process and transforms it into actions in mental representation models.

Kenneth Craik (1943) explains mental models with the idea that the mind is the model of small-scale reality. Accordingly, the mind processes information it receives from reality by reasoning and forming relationships. In this case, the mental model has intersections with the previously mentioned idea of a simulation of the world. However, at this point, the model has the potential to collect parts from reality and generate ideas from them and create a new reality. Beyond this early definition, in 1983 Johnson-Laird published a more detailed and comprehensive study of mental models. Accordingly, supporting Craik's theory, mental models define temporary structures in working memory. These structures were supported by psychological

experiments and were thought to represent reality by including long or short-term memory (Johnson-Laird, 1983). Accordingly, there are 3 different representations as propositional representations consisting of syntactic symbols and formulas relating to context, mental images formed with perceptions obtained from real experiences and information, and mental model, which is the whole of analogical representations where these two come together and enables mental actions to take place (Johnson-Laird, 1983). Considering the relationship between mental models and symbols, the propositional representations that were previously explained are also included in the symbol system (Fodor, 1975). In this case, the mental model is a systematic representation that comes together as an individual formation, and what provides cognition and learning is the set of experiences and symbols that establish the mental model (Seel et al., 2000).

The information processing structure brought by mental models makes us question the existence of a systematic representation. The mental model that works with working memory processes the information it receives from the past in the present, resulting in inferences about the future. These inferences can be equated with the associative and experiential functions of imagination. However, it is thought that the existence of systematic representation also explains the idea generation points in mental representation. Accordingly, the iterative and transformative functions of imagination can be seen as a phenomenon that performs the reasoning and problem-solving actions of the mental model. In design thinking, it is inevitable to explain mental representation with such a model. However, design thinking is also seen as an area of reasoning where syntactic explanations and experiences that are reflections of reality come together. In this case, the mental model can have a place in design practice and design education, as it is individual, includes all types of knowledge, and offers a systematic understanding.

Starting from design thinking, mental representation is seen as an important resource in terms of understanding how the designer approaches and perceives design from his mind. This resource can be associated with conceptual design with the notions it contains. At this point, the mental model is seen as a reflection of reality, it represents what is in the mind of the designer, but does not structure the relationships, meanings, and concepts it contains. Mental representations, apart from the structure of mental models depending on symbols, such as taxonomy, script, scenario, frame, schema,

ontology and semantic network are included in knowledge representation theories (Patel & Jain, 2018). In design thinking, these structures can be discussed in terms of approaching the problem, creating new knowledge and establishing creative relationships. It seems more efficient to follow a comparative method to describe these knowledge representation structures to understand design thinking.

To begin with, the semantic network semantically structures the relations with the representation it establishes over memory. Ontology, on the other hand, establishes the meaning of concepts within a structure that includes relations and functions but uses these as a "representation vocabulary". (Salem & Alfonso, 2008). It is seen that both knowledge representation and processing models are related to concepts and show a categorical formation by referring to taxonomy. Bowles (2017) also refers to ontology, takes the behavior of concepts and entities as data and defines a graph. Accordingly, ontology can be defined as a domain that can process the information rather than just representing it (Bowles, 2017). Ontologies can relate to and represent multiple categories and concepts. The category approach, which dates to Aristotle, enables knowledge to establish analogical relations in the mind. When examined in this context, ontologies consider concepts and information as a whole and form a basis for artificial intelligence theories. The semantic network, which has concept networks like ontologies and put forward by Quillian (1967), is also a graphic-based knowledge representation model for verbal memory. Accordingly, semantic networks' graphical representations contain nodes and links. While this representation can be treated as a diagram, concepts, objects, events are shown as nodes and the relationship between them as links (Quillian, 1967). Compared to ontology, the links between concepts do not show any logical or functional relationship, they are the graphic notations showing the existence of the relationship between them (Borgida & Sowa, 1991). Therefore, knowledge representation is interpreted as a set of bilateral relations and semantic integrity must be re-established for the addition of new knowledge. In this case, while ontology provides a more general scope in distinguishing it from the semantic network, the relationships it establishes can spread over a wider area, as it includes concepts that provide more diverse meaningful connotations.

Because of the characteristics of its functions described in the preceding chapter, imagination employs a different mental representation model, whereas semantic networks and ontologies represent definitions independent of experience. The mental

representation model known as schema can be used within the context of imagination in this case. Frederic Bartlett (1932) mentioned schema in his studies on learning theories and structured schemata as active processing of concepts concerning past experiences. Bartlett's theory may be seen as abstract linkages and representations in which one's experiences and knowledge are defined and processed to develop new knowledge. In their work on schema theory, Rumelhart and Ortony (1977) focused on four features of the schema.

> 1)Schemata have variables; 2) Schemata can embed on within the other; 3) Schemata represent generic concepts which, taken all together, vary in their levels of abstraction; 4) Schemata represent knowledge, rather than definitions (Rumelhart & Ortony, 1977, p. 101).

These features of schemas are compatible with the wide scope of imagination, its relationship with experience and memory, and the new linkages established by abstracted meanings. In this case, schemata, as the mental representation of imagination, is focused on both as a model and as a set of actions in the thesis for the identification, processing, organization and reuse of knowledge. Beyond schema theory, this model has been the subject of different theories such as frame (Minsky, 1975), scenario (Sanford & Garrod, 198) (**Figure 3.2**).

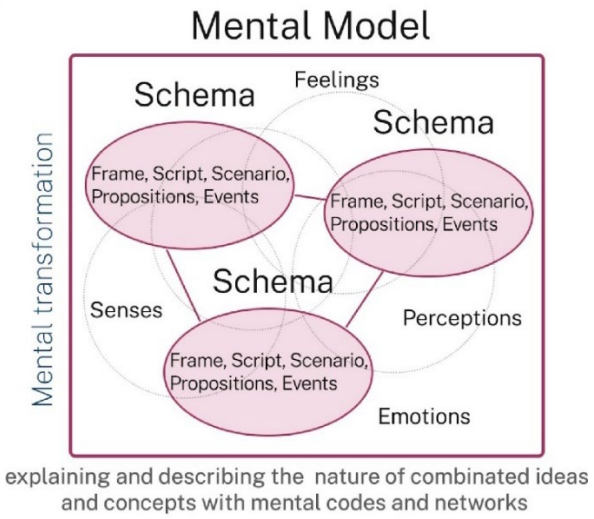

Figure 3.2 : Schema and mental model (Adıgüzel, 2022).

The features provided by schema theory can be summarized as being a dynamic structure, processing both procedural and declarative information with its structure based on experiences and events, making retrospective operations, having direct definitions of mental representation, associating individual characteristics with memory, and providing a structural construct in information representation. In this

context, the representation of imagination with schema theory in design thought is considered a potential situation. The potentially non-hierarchical dynamic structure enables mental representation to situate the design process on a structure that offers dynamic and unlimited relations. In this case, the creative thinking action provided by imagination is included in the mental representation with the actions for the processing of the schemata. In the next section, how it is involved in schema theory and design thinking will be explained in detail, and the position of the functions of imagination within the mental representational structure will be discussed.

3.1.2 Schema theory

The features of schema theory can be reconciled with the representation of imagination functions. This section also aims to reveal how it takes place in the design process by explaining the relationship between the two. In this way, within the scope of the thesis, why mental representation is associated with schema theory will be revealed through the structure discussed. For this, the scope and formation of schema theory will be explained through the context shown in **Figure 3.3**.

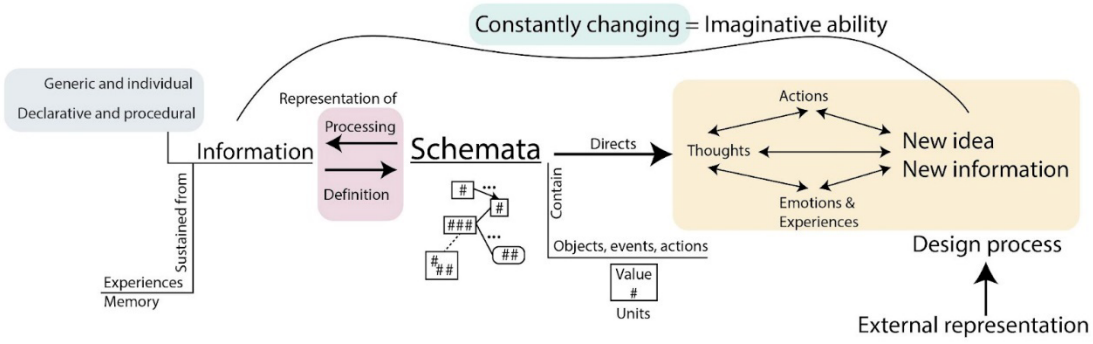

Figure 3.3 : Schemata in design process (Adıgüzel, 2022).

Looking at the meaning of the word "schema", it is understood that it represents a shape or plan (Seel, 2012). Even from this point of view, it is understood that schema theory ascribes an order/pattern/diagram. The concept of schema and schema theory is studied as a psychological basis for learning and information processing and is based on Plato. Plato handled the mental representation used as imagery together with abstract concepts (Martinez, 1999). Kant (1787/1999) developed the concept of schema and defined it as a structure that organizes our world. In the Critique of Pure Reason, Kant (1787/1999) also connects the concept of schema with imagination. Accordingly, the schema emerges as a representation of imagination and contains the

concept-image duality. While this mental model, which is formed without limitations, cannot be expressed with a single image, it is connected to a general structure with the categories and relations created. To take the example of the ‘dog’ schema, the information structure in the schema as a four-legged animal defines an infinite perception within the processed experiences (Seel, 2012). Based on all these basic and preliminary definitions, it is understood that the schema includes both general and abstract information, as well as visual and non-visual concepts, and accordingly reveals the meaning of the concept. In the representation of imagination, this situation can be read through different functions.

Bartlett further explained this issue with his experiments in cognition and psychology. According to Bartlett (1932), individuals have general and typical knowledge regarding the unconscious and related mental developments. Accordingly, the combination of old and new knowledge is possible with schemata. At the beginning of the twentieth century, he advanced schema theory with the influence of behaviorist theory. In this context, schemata connect to experiences by initiating a stimulus-response relationship between old and new knowledge. The stimuli provided by the experiences enable the schemata to establish new meanings and relationships in mental representation (Bartlett, 1932). In this case, the reactions or behaviors that occur are also mentally represented, allowing the schemata to be processed. However, since this early definition of Bartlett has a dominant relationship with remembering, he also attributed the recall and associative features of memory to the schema (Brewer, 2000). Later, studies on schema were advanced by focusing on concepts such as long-term memory, narrations, and behavior. Based on Bartlett's schema theory, the relationships between existing knowledge, experience, new knowledge, and the dynamic structure of the mind are discussed in detail in the literature on psychology. In this context, when schema theory put forward by Bartlett is considered in design thinking, it is possible to think of creativity as the process of bringing together old and new knowledge. In this case, the reproduction of the schemata considered in categories with new experiences and the diversification of the meaning with the established relations make different functions of imagination visible.

Schema theory is evaluated within the framework of cognitive development. Piaget (1952) developed mental representation with a similar approach to Bartlett, influenced by Gestalt theory. Consequently, it categorizes the information by coding the

information and establishes the relationships through the schema in mind. According to Piaget (1952), schema theory plays an important role in the cognitive development stages of the individual. The individual learns by experience rather than the main information in his mind and tries to fit the situations that are experienced into schemata, which are mental representations, to modify and establish a new model. Piaget (1952), who explained it in two stages as assimilation and adaptation, equated the learning process of the child with the experiences of the individual. Following Piaget, assimilation was considered the use or modification of new information to fit into the existing structure, while accommodation was considered the establishment of new relationships, that is, the change of the schema, for the placement of new information in the structure (Mcleod, 2009). In this context, it can be said that mental representation is used as a tool of dialogue with the outside world, where the information between old and new experiences is processed. However, embedding new knowledge in the mind, which is processed individually and unconsciously, can be considered a situation that shows the creativity of the individual. For example, the concept of a house in a design problem presents a general scheme in every mind; the experiences gained in the scheme will affect the approach to the design problem. While the existence of concepts such as doors, windows and rooms in the network formed can be considered a general acceptance, the other information that the individual matches these concepts with, and the meaning of the built relationship is in a position to destroy the hierarchy. In this case, the content of imagination against the design problem gains a creative feature according to the diversity of the path followed in the schemata. However, this situation can be considered an individual effort as it is within the existence of the learning and development stages that Piaget put forward. At the same time, in architectural education, students need to diversify the schemata in their minds and learn how to recall the aforementioned stages in the design process so that they can acquire design thinking. This situation becomes practical in the following classes and is an element that nourishes the concept of architectural design. In this case, imagination is included in the design with its different functions in the process of acquiring, diversity, production and use of knowledge.

In the 1970s, schema theory began to take place in machine learning and artificial intelligence with the work of Marvin Minsky. Minsky (1975) developed the frame theory, similar to Bartlett's schema, and accordingly worked towards machines

imitating the information that humans store as schemata. In this context, he used the information processing method carried by schema theory as a representation model. He proposed to represent the fixed generic information as a slot frame that accepts a certain range of values. In this way, details about how schema theory stores and reprocesses information are explored. Also, Minsky (1975) applies a default value if there is no value for new information and places it in frames. If we continue this with the example of the house we mentioned, the individual attributes the characteristics of a certain door value to the frame of the house that the designer imagines and represents in the mind. In this case, it is possible to think of the structure established by the schemata as a shortcut, and it can be argued that minimizing the generic, that is, default values, opens the way for creativity. In this case, the values of the schemata can be expanded together with the lived experiences, and the information that does not carry any value is associatively placed in schemata and its representation is created unconsciously. Beyond the inclusion and representation of new information in the mind, the production of new information in design thinking can also be questioned within the existence of these values and relations. In line with the scope of the thesis, if the place of imagination in mental representation is considered the process of creating design knowledge, it is seen that schema theory is established with the relationship between the categories it contains, generic information, experiences and the values of all these.

Furthermore, Rumelhart (1980) stated that schemata are the organization and data structure of all the information that the individual has. These organizations called units are the packages of the concepts in memory. By that statement, it can be understood that schema is not only the whole structure of the generic knowledge but also all types of information connected within a unit embedded as the patterns of information processing. Rumelhart (1980) then opens the content of the knowledge within the framework of schemata by defining it as.

> Schemata can represent knowledge at all levels from ideologies and cultural truths to knowledge about the meaning of a particular word to knowledge about what patterns of excitations are associated with what letters of the alphabet. We have schemata to represent all levels of our experience, at all levels of abstraction. Finally, our schemata are our knowledge. All our generic knowledge is embedded in schemata (Rumelhart, 1980, p.41).

Accordingly, schemata not only represent generic information but also provide a whole structure that includes objects, situations, events, actions and their sequences.

Rumelhart (1975) also proposed the story grammars that define the representation of experiences handled as stories with a basic semantic diagram. According to the work of Mandler (1984), the schemata are divided into categories based on Rumelhart's grammar. Mandler (1984) categorizes schemata as situational schemata (frames), action schemata (plans) and the term "grammars" to process mental representation as a whole set of experiences (Seel, 2012). Based on Rummelhart's grammar, Schank and Abelson (1977) contributed to schema theory by calling it script. Accordingly, schemata or scripts structured as a process have formed propositional knowledge and placed objects, events and actions on a distinct level. They argued that there are deeper relationships in scripts because different features and values continue to exist in the same action structure and that these combinations are represented in the same grammar against complex situations (Schank & Abelson, 1977). From this point of view, it cannot be described as a direct copy of the real world, nor does it reject it directly. Schemata encode all information abstractly and concretely with its various values. It is discussed within the scope of the thesis whether this coding follows a certain pattern or whether it ascribes rules as a feature of imagination in the process of producing the new. In this case, the main issue that needs to be examined is how concepts and ideas come together in individuals and form information systems, rather than whether the mental representation is visual-verbal or abstract-concrete in the schemata. The creative point here is considered the stages of formation, activation and use of schemata. Thus, in the design process, the formation scheme of design thought can be examined in the context of established relations and created actions.

Anderson (1976) argues that schemata contain both declarative and procedural information distinctively. Accordingly, schemata function as a tool in problem-solving and learning access through both information types with old and new information processing (Anderson, 1976). The value of the materials and components in the house scheme is clustered with its different characteristics when it functions as a living space, within the features such as material as wood and the context of rooms. With this approach, the schemata belonging to the superset describe both how it is formed and what it is, within the relationships it constructs, thus it carries both procedural and declarative information through the basis of information learning and problem-solving. In the design process, the schemata in which the given problem is located and related are changed to solve the "what" and "how" questions. In this case, the dynamic

structure of the schemata can be mentioned. The dynamism here is a feature that opens the way for imagination and also consolidates design thinking. The diversified slots and values between old and new information can be connotations that direct the design, as well as describe a cluster that carries general information. Clustering, which can be described as categorization, describes situations such as objects, events, and actions, and is dynamically nurtured from daily life under the questions of what and how. However, although Anderson (1976) also argued that the flow of information in daily life cannot be narrowed down to schemata, its complex and dynamic feature coming from previous theories causes us to consider it as a mental structure suitable for the design process.

Considering that mental representation creates a structure in a node-link relationship, the features that emerge from the schema theories explored in this section can be defined within the scope of the thesis as follows:

- Contains generic and individual information.
- Represents both the definition of the information and the processing of it.
- Contains declarative and procedural information.
- New and old information can change each other as they come together.
- Objects, events, actions and all related information have value and are packaged as units.
- The schema structure can be considered a representation of memory.
- It has a dynamic structure; it constantly changes itself with newly added knowledge and experience.
- Due to the values it contains, it has the capacity to abstract, thus establishing the abstract-concrete relationship.
- It is sustained from daily life experiences.
- It direct actions and allows for the forecasting of possible outcomes.

3.1.3 Proposal for mental actions through schemata

Based on these features of the schemata within the scope of the thesis, it is possible to define how imagination and new knowledge emerge with different processes in design

thinking. In this part of the thesis, schema theories will be explored together with the stages they went through, and the mental actions associated with them, and their relationship with imagination will be explained. With this study based on the previous research stated in the thesis, the creation of schemata is divided into three stages and their related actions in design thinking (**Figure 3.4**).

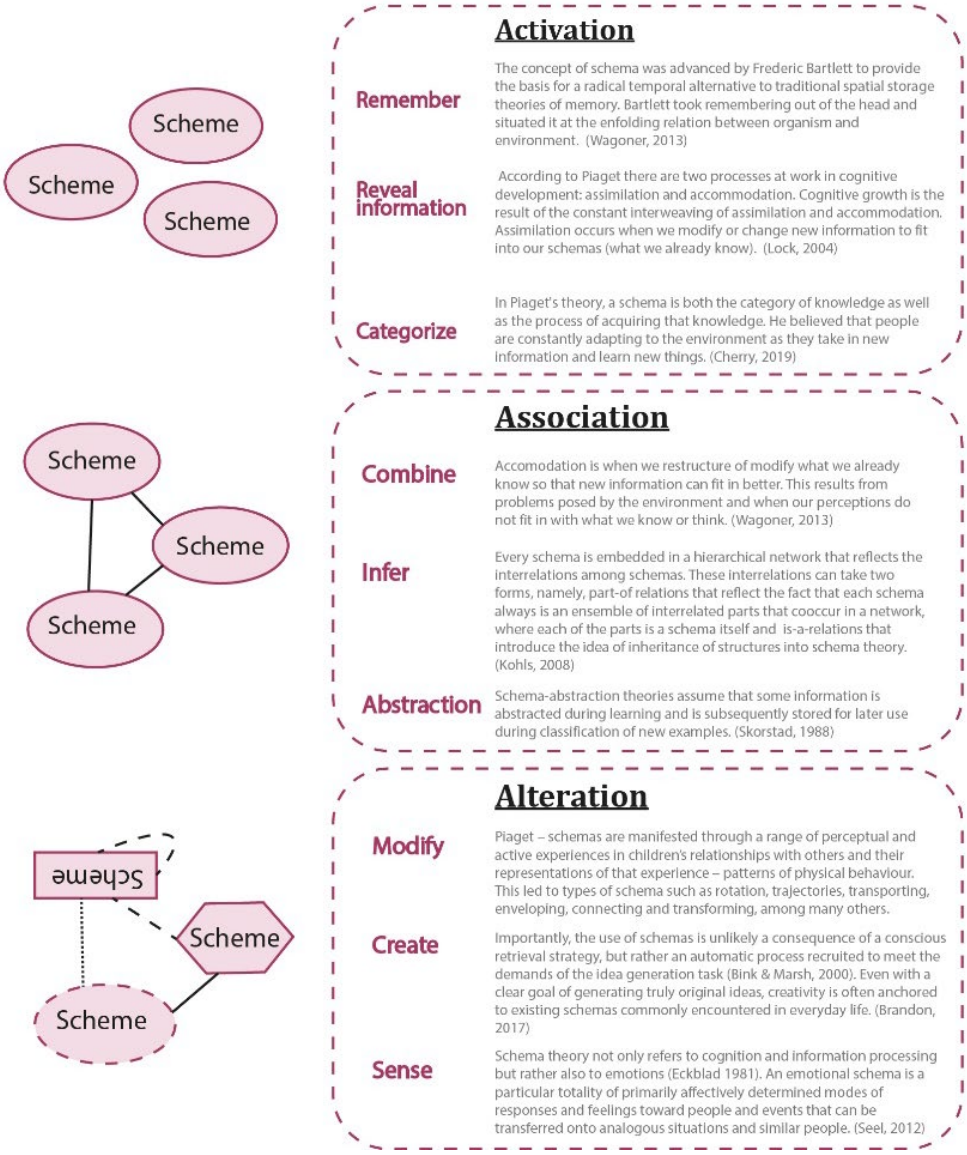

Figure 3.4 : Schema theory and its actions (Adıgüzel, 2022).

These stages consist of activities such as;

1. Activation; remembering, revealing information, categorizing,

2. Association; combining, inferring, abstracting,

3. Alteration; creating, modifying, sensing.

The process that starts with the activation of schemata presents a constantly changing mental structure with different inputs (Kohls & Scheiter, 2008). The activation process was seen directly related to memory and was examined as bringing back the existing information, coding the new information and shaping it with the information in the schemata. As discussed by Bartlett (1932), this process is linked with remembering and defines it in the memory. Assimilation and accommodation, as proposed by Piaget (1952), are investigated as the development of new knowledge in schemata. Again, according to Piaget's (1952) definition, schemata are categories of knowledge and people adapt to the environment by constantly coding and placing their new experiences into schemata. In this case, the unification, connotation and representation of information in the context of acquired codes can be collected in the process called activation when the schemata are activated to be involved in the design. Furthermore, the activation stage consists of mental actions investigated as remembering, revealing information and categorizing since they indicate the information's place in memory and therefore in schemata. In the design processes, the use of existing knowledge, combining new experiences with other information, and bringing an associative approach to the design probes, which are called ill-defined problems, are included in this process. If an example is given from architectural design education, it is seen that the schemata in the activation stage in mental representations are adapted to the problem by stimulating them. The student, who is given a design problem, categorizes the data he/she collects about the problem with his/her analysis, diagrams it and leaves it to the next stages to use in the design process. In this whole process, the situation that reveals imagination is hidden in the structure brought by the remembered information. In this case, the point where imagination comes to the fore; as focused on associative function of imagination, the relationship with memory can be thought of as the variety of activations, specifically in the remembering action.

Other stages defined for the use and association of schemata also have a meaningful place in design thinking. The use of activated schemata is discussed in the thesis with the association process. Considering association as the collection of activated schemata, it establishes a link between Piaget's (1952) assimilation and accommodation stages. These stages, whose definite distinction cannot be given, are examined under the name of the association, with the meaningful relations they carry beyond the placement and representation of the information in a schema. When

examined in this context, the action of combining enables the establishment of new subcategories based on the idea of linking schemata. Here again, it is possible to trace the associations and the conceptual thinking. Kohls and Schneiter (2008) argue that the relationships between schemata will take two forms; “part-of” and “is-a” relations. Accordingly, each schema is a whole in which interrelated information comes together in a network, and the idea of inheritance of networks considers schema theory as the phenomenon that constitutes this whole. In this case, the activation process discusses how the schemata relate, and it is handled as a semantic relationship that progresses with inferences rather than the combining phase (Kohls & Schneiter, 2008). The inference is distinguished from the "combining" action in the design process with the conscious design decisions it contains and the codes that the relations themselves carry, rather than categories. “Abstracting” action, on the other hand, is considered input of the design, but it starts at the stage of categorizing the information in the schema-abstraction activation process (Skorstad, Gentner & Medin, 1988). At the point where the categories are determined, the separation of a new experience into information and accordingly its distribution into categories within the framework of an association shows the state of mental representation dealt with by abstracting. Looking at the association process, design thinking can be defined as the situation in which activated information is associated with each other. If we take an example from the design process, bringing together the information about the activated design problem at the conceptual phase, connecting them with metaphors, and producing alternative solutions by abstracting can be related to the status of the schemata in the association phase. In this context, design is seen as a process of association; therefore, different functions of imagination can be processed together. While combining and inferring, which are the actions provided by the association, cooperate with associative function of imagination within the design thought, the abstracting action manifests itself in iterative function of imagination.

Within the scope of the thesis, apart from activation and association stages, schemata are discussed with the changes they have undergone, and the process examined with the stage named alteration. It is possible to define a process of change, including assimilation and accommodation, when new information comes together with the existing. Considering this process together with "modifying", "creating", and "sensing" actions; It also describes the point where design thinking becomes the most

creative and the route through which new knowledge is produced. In this case, the modification of the schemata not only relates to the transitions between the categories and codes but also ensures the differentiation of the relations and the formation of the novel idea. Beyond that, it explains how to come up with original ideas from mental representation schemata that can be treated by "creating" action. It is not correct to define schemata as a structure that contains only existing information, or as a system in which new information is processed (Bink & Marsh, 2000). However, the coexistence of daily life and existing schemata also paves the way for creative thinking. Experiences and problems encountered in daily life activate schemata to produce solutions within the relationship between concepts. In this case, diversification of relationships and examining their meanings as an idea generation task is seen as an important part of alteration. Furthermore, it has been stated before that those schemata also cover non-material situations, but the ability of senses and feelings to change schemata should also be considered within the scope of the thesis.

Seel (2012) structures a schema called "emotional" related to the works of Piaget and Eckblad; defines it as a reaction mechanism against events and situations by associating it with real life. With this definition, while the act of sense can be considered a mental reaction, it reveals the situation of combining existing schemata with immaterial schemata. In this case, schemata are more than just a storage structure, they reveal their dynamism again and attribute their importance to established relations. When considered within the design thought, mental representation inevitably promises dynamism under the alteration process. The changes made in the approach to the design problem, the added information, and the solutions produced seem possible with the presence of alteration. To give an example from its relationship with imagination, a structure processed in an evolutionary process is rotated, changed, and brought together with different actions under the influence of the action of modifying in the mind, and its counterpart is sought in real life. Exposing schemata to the process of change in architectural education reveals various modes of thinking and can be used as a thinking exercise that strengthens perspective and creativity. Due to the given tasks, the solution for the design is in constant transformation in the minds of the students. The existence of these transformations also nourishes the dynamism of the established design thinking scheme.

Schema theory, which is considered a model for mental representation, provides a basis for explaining the representation of design thinking supported by imagination with its relationship with the physical world. In this context, schema theory takes place in the approach to the design problem as a state of mental information processing. Thus, mental representation is discussed with schema theory, since it describes both definition and action, enables the production of imaginary ideas with the relations it contains, and is included in the design process. Beyond that, it is a constantly evolving representation with its dynamic structure based on experiences. Together with external representations, it reveals the dialogic feature of imagination. In addition to external representation, which will be explained in the next section, how schemata are included in the design process in the context of imagination will be discussed in relation to external representation. In this case, the features of imagination that form a dialogue between external representation and mental representation will be structured in design thinking (**Figure 3.5**).

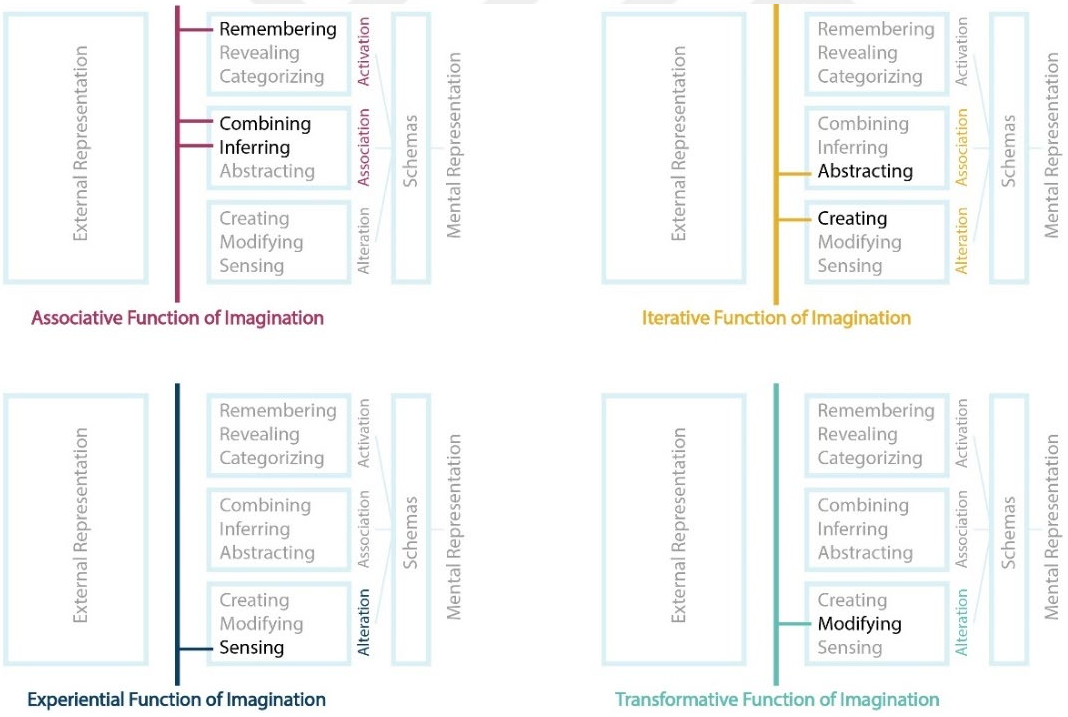

Figure 3.5 : Mental actions and their relation with imagination features (Adıgüzel, 2022).

3.2 External Representation

Considering the relationship between imagination and mental representation, it is not possible to create new knowledge without external stimuli and experiences. External

representations that support and are guided by mental representation can be defined as the medium where imagination meets reality. In this case, it can be said that imagination builds a bridge between the mind and the real world and creates a dialogue. External representation can be considered the reflection of mental representation in reality, and mental representation can be considered a simulation of external representation. The ability to produce representation and flow of information in this symbiotic relationship establishes the main parameters of imagination. In particular, external representation diversifies within design thinking and the design process, revealing the mind of the designer and preparing an environment for the development of a design. In this context, it is possible to follow imagination through the route created by the designer between mental and external representations. External representation, which can be handled within the framework of product and action, is discussed in a way to explain how different media and tools are involved in the design process, how they make sense and how they relate to imagination.

3.2.1 Media and tools

The design content is created in the relationship between mental representation and external representation. External representation functions as a medium or tool that supports and clarifies the dialogue between the designer, the design problem, and the mental model. The bridge between mental and external representations is the activities of the designer used and triggered by verbal, visual and behavioral tools.

From the perspective of cognition, mental representation is in a symbiotic relationship with external representation. When we analyze mental representation by associating it with memory, it is possible to define it as an information processing mechanism that together structures existing and new information. In contrast, external representation is described through a physical environment as information in that environment and its structure. In this case, symbols, objects, and relations gain physicality and it is transferred to mental representation entangling with the perceptions of the individual (Zhang, 1997). However, it is not necessary to define external representation as merely the input and stimulus of mental representation. Although external representation can be considered a whole that provides the relationship of knowledge with physicality, it also defines the reality that the individual comprehends and perceives. External representation, which can be taken as examples such as pictures, graphs, writings,

diagrams, or objects; has an important place in problem-solving, decision making, reasoning and therefore design thinking. In this case, it is also possible to use external representation to describe situations that can be perceived and present a physical presence. The actions, productions and physical responses of the individual in the physical world in response to mental representation, that is, the schemata, which are nourished directly from the relationship that the individual establishes with his environment, constitute design process. A large part of the information in mental representation is carried by the reflection of the structure of the physical world (Zhang, 1997). Within the scope of the thesis, external representation in design was examined within this ambiguous structure. It is examined both as a product and as the behavior it creates. It is questioned how the physical environment is perceived in response to the schemata in the mind and how mental schemata are represented in the physical environment during the design process. However, imagination also acts as a bridge between the past and the future, as well as between the mind and reality, with its role as a dialogue between this ambivalent situation. If it is thought that external representation reveals what is in the mind or activates cognitive behavior, the pursuit of imagination can be read through representations as discussed in the thesis. In this case, external representation functions as an interface that questions the traces of imagination.

Eastman (2001) states that the design process is built on the designer's conceptual world consisting of mental representations and external design representations in the real world associated with sensory modalities (**Figure 3.6**).

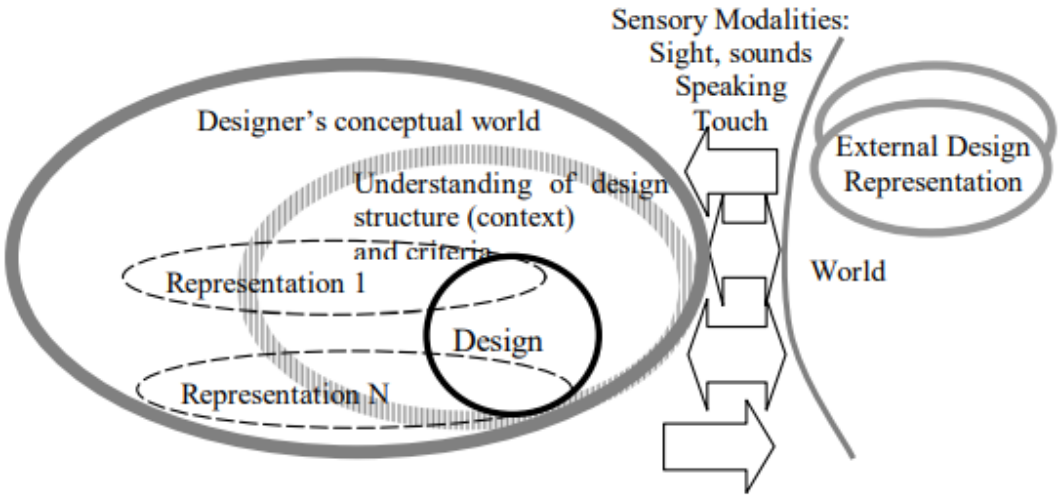

Figure 3.6 : Designer's conception of a design (Eastman, 2001).

> The central area of concern is the designer's conception of the design world, that is, of the design and its context. To develop this design world, a designer has multiple sources of information: the external world of objects and observation (example designs, the context of other designs), external sources of encoded information (such as books, the Web, drawings), and the internal recollection of previous experience and learning. The external sources provide information in different encodings. Books are encoded in words (in various colloquial or formal vocabularies) and mathematical formulas (in different notations such as sets, algebra or calculus), the physical world in the form of images and possibly tactile, motor and auditory memories (Eastman, 2001, pg.5).

The representation referred to here is both mental and external representation. But it is the dialogue of mental representation with external representation that provides the essence of design. Considering the cognitive aspect of design, mental representation is seen as an inevitable phenomenon in the act of thinking and imagining. However, external representation is called design representation; therefore, the design process should be emphasized as its counterpart in the physical world. For the complete crystallization of the design in the mind, external representation must be created. At this point, the role of the designer also becomes complex and functions as a dialogue-maker that connects the mind and the real world rather than being the individual who makes the design. Design education also lies in the relationship between the mind and the external representation, which establishes the development and creativity of designers. In the previous section, it is possible to understand that the design process differs with various inputs and approaches. Accordingly, design representations are also diversified with different approaches and practices in externality. Before explaining these representations, it is necessary to discuss what external representation means in the design process.

Dix and Gongora (2011) explain the relationship between external representation and mental representation within 4 different functions: informational, formational, transformational and transcendental (**Figure 3.7**). The informational function enables the designer to transform the design in his mind into a communication and transmission tool through external representation. While the formational function can be observed spread throughout the design process, it provides a clear rendering of the blurred schemes in the mind. At this point, a loop occurs between the mind and the external representation, and the external representation presents an unfinished state. Transformational function accompanies the design finalization process together with external design tools. In this case, external representation enters a transformation

process with actions such as testing, finalizing and defining. While the transcendental function defines the concept stage of the design, it enables the abstract descriptions and relationships in the mind to become objects in the physical world and become perceptible phenomena. However, they are all related to each other, and it is seen that mental and external representations constantly enrich each other and establish the design process.

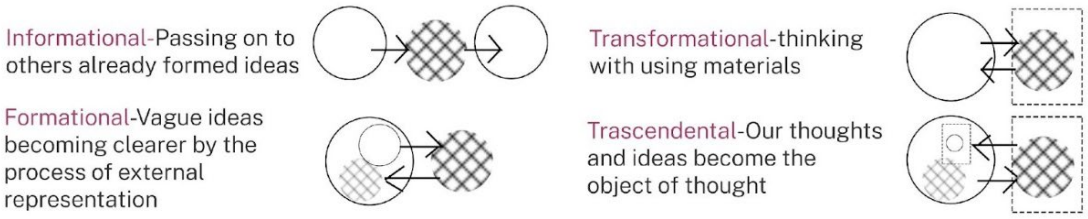

Figure 3.7 : External representation functions (Dix & Gongora, 2011).

While investigating the designer's way of using imagination within the scope of the thesis, the traces toward mental representation are followed by starting from the external representation. According to Eastman (2001), the design process occurs in the relationship between external and mental representations, and he investigates design thinking through behaviors captured from the protocol, which he classifies as verbal, visual, and gestural. In this context, in the next section, external representations are differentiated verbally and visually, explored through actions and behaviors, and their diversity in design thinking is explained. Thesis focuses on verbal and visual representation media since they can be followed with concrete tools, therefore design actions refer to behaviors taken while creating the representations and design content.

3.2.2 Verbal and visual representation

It is possible to consider external representation tools as binary media under the name verbal and visual. This issue can be examined more clearly in external representation, which is based on the verbal and visual work of the mind and beyond the mentioned mental representations. In this context, it is aimed to focus on the means of representation and explain them by evaluating the two as separate categorizations. How imagination is layered visually or verbally through external representation media will also be discussed in this way.

While external representation can be provided with texts, scenarios, manifestos, and definitions that emerge with the act of writing, it can also be provided with diagrams,

mappings, sketches, collages, models, and videos that emerge with visual techniques. In addition to these, the design process in the computer environment comes with a different approach to the subject of external representation. However, it is possible to separate the external representation visually and verbally without separating it as analog or digital. In their protocol analysis study, Akın and Lin (1995) emphasize the importance of using verbal (conceptual) and visual (graphical) representations together in design thinking. As a result of the analysis, they determined that the visual representation was dominant in the design process, and the verbal representation was used as a reflection of the visual representation. In this case, the two can be considered modes of representation that work together and support each other. According to Goldschmidt and Sever (2011), visual and verbal representations complement each other, and creativity exists in their interaction. While verbal representation is explanatory in the design process, visual representation is compatible with perception, according to this relationship. Çıkış and Ek (2010) mention that the use of visual and verbal expression together, that is, in dual mode, is a situation that nourishes the design in the design process and strengthens both its expression and the versatile dialogue it establishes. In this case, although visual representation methods seem to be primary in the architectural design process (Casakin & Goldschmidt, 1999), verbal representation also plays an important role in the externalization of concepts and even in the treatment of visual representation as reflection. At this point, the symbols used in visual and verbal expression serve as a mirror for mental representation and when they come together, they form a meaningful whole that connects with the real world.

Speaking and writing will be the first actions that come to mind, considering the environments and tools in which external representation is transmitted verbally. The environment where these actions take place can be accepted as a continuous dialogue in practice, as well as the studios where architectural design education takes place, but the situations in which this is handled in a literary way represent the dialogue that the designer has built. From this point of view, while it is possible to deal with the verbal representations included in the design process with physicality in the act of speaking, it is also possible to handle it as self-talk or internal talk. However, what is important here is what verbal expressions make possible in the design process and in what form they can be observed.

Goldschmidt and Sever (2011) define the place of verbal representation in the creative thinking process concerning visual representation. Accordingly, words or sentences form a base for visual representation, gain a translation quality in establishing cause-effect relationships, and serve an explanatory function in seeing and showing concepts (Goldschmidt & Sever, 2011). If privatized, keywords that trigger and transform visual representation, according to the study of Nagai and Noguchi in 2002, are included in the design process by determining a scope between abstract and concrete. In this context, words, sentences, definitions and concepts define a scope between the abstract and the concrete, while they are associated with the visual representation and create a reflection. In this case, the creative design process attributes itself as a situation circulating between dualities in the dimension of external representation.

According to Goldschmidt and Sever (2011), ‘concepts’ are the key elements to making design decisions in the early phase of design process. Akın (1986) defines these concepts as verbal representations that relate the design idea and real world. This supports Goldschmidt and Sever's approaches to the design process and shows that verbal representation has a complementary structure towards producing visual representations and making design decisions. When we look at the potential of verbal representation through 'concept', its existence as a trigger for the formation of ideas gains importance. At this point, as mentioned, verbal representations can be descriptive as well as play a decisive role in the representation of abstract information. At this point, as mentioned, verbal representations can be descriptive as well as play a decisive role in the representation of abstract information. Considering the relationship between the design process and poetic thought and therefore language (Bachelard, 1969, & Pallasmaa, 2012), it is inevitable that concepts and architectural design decisions are verbally constructed to create images. Verbal representations can appear as verbal definitions, descriptions, keywords, metaphors, narratives and formulas when considering their role in the design process.

Stouffs (2015) refers to Stiny (1981), emphasizing the importance of descriptions in the design process. Accordingly, verbal descriptions are included in the design with different tasks; “as reflecting on the spatial elements and their composition, as expressing some property, as a design brief and as a generative guide” (Stouffs, 2015). This approach can be associated with verbal representation representing concrete design decisions, and representations expressing final decisions such as formulas can

also be included in this category. However, using the language in the design process can also describe a freer approach that will trigger the use of other representation media. This free use of language can be seen with metaphors and analogies which are discussed as the productions of concepts in the architectural design process (Casakin, 2006) Accordingly, metaphors and analogies, with their similarities and differences, establish the relationship between the knowledge and experiences that exist in the minds of designers during the design process, are used to bring different concepts together, and enable designs to be grasped and developed with these associations. In his study on metaphor and the place of analogy in the design process, Casakin (2006) argues that metaphor can be considered a type of analogy because there are situations such as similar abstraction and re-representation in the structure created between the problem and the solution. Beyond the similarities, there are differences between analogies and metaphors in terms of the features they carry within the structure they create. Gentner (1982) expresses these differences by explaining that analogies are used for predictive purposes, while metaphors are used for both predictive and expressive emotional contexts. In this context, metaphors hold deeper relationships than analogies. In his discussions about metaphors and analogies, Casakin (2006) focuses on the conceptual stages of design and argues that unconventional thinking is possible with such comparative framing. Similarly, Goldschmidt's work with Sever and Casakin at different times discusses that analogies and metaphors used in the early stages of design have an important place in developing the concept and making design decisions referring to visual representation and emphasizing the presence of these concepts in visual representation (Goldschmidt & Sever, 2011; Casakin & Goldschmidt, 1999). Analogies and metaphors make the designer approach the problem in an innovative way beyond the known schemes as a result of the relationships and comparisons they establish. While talking about experiences, scenarios, stories and representations that define processes, which are verbal representation tools, have an important place in architectural design thought as they contain information about experience. Stories that are based on experiences can be thought of as a graph with a sequence of events and a focus on time and space. Frascari (2011) says that narrative representation media, including storytelling, enable architects to develop new approaches, make arrangements, convey their designs, and establish a link between the past and the future in the design process. Thus, he argues that this representational medium describes a process and in fact, the design process is

a narration (Frascari, 2011). At this point, it is possible to define narration as the transfer of the process in which experience and events are at the forefront. In this case, the scope of verbal representation reveals different orientations from abstract to concrete, from movement to stability, from a frame to flow, and from analogy to reality in architectural design thinking. Therefore, considering its mutually triggering structure and its relationship with mental representation, it has a great place in the design process and is compatible with the wide scope of these relationships that it establishes with imagination.

As previously stated, verbal representation alone is insufficient to establish the design process, and because architectural design is conducted with images, the existence of visual representation methods is required. The design process is a non-linear process in which ideas are externalized and reach their physical counterparts in different forms. These forms appear with different dichotomies such as verbal and visual, abstract and concrete, spatial and non-spatial, and clear and blurred. When the idea of design in mental representation is transformed into external representation by various factors, the body and hand feel the need to transfer it to paper or another tool. Drawing and sketching, according to Cross (1999), play an important role in the design process because the desired design product becomes negotiable and observable with all its features. Goldschmidt (1991) defines drawing and sketching as a designerly habit. Therefore, they contain not only experimentation that focuses on the final product, but also designer-specific qualities and establish creativity. Goldschmidt (1994) emphasizes the potential of drawing methods and tools, as well as the evolution and transformation of design thinking and the existence of coordination between mind and hand as a result of its dialogic feature. Accordingly, sketching ensures continuity in the architectural design process, allows for the experimentalization of design ideas, and serves as a visual framework for the crystallization of what is in the mind. Drawing, with its layers, features, and actions, targets both the design process and the design idea in this case. The externalized representations that arise in this case come together with symbols, inscriptions, and shapes to reveal an idea. In architectural design thinking, externalization is transferred to other environments within this body-hand-brain relationship and becomes visually perceptible. These visuals appear as diagrams, plan-section-perspective drawings, storyboards or collages and videos where different tools come together in the design process.

The diagram, which represents the relationship of the design idea in the design process, is examined as a representation medium that is constantly reproduced with different inputs and outputs. Andrew Chaplin (2014) divides diagrams into 18 categories in his text The Architecture of Diagrams (**Figure 3.8**).

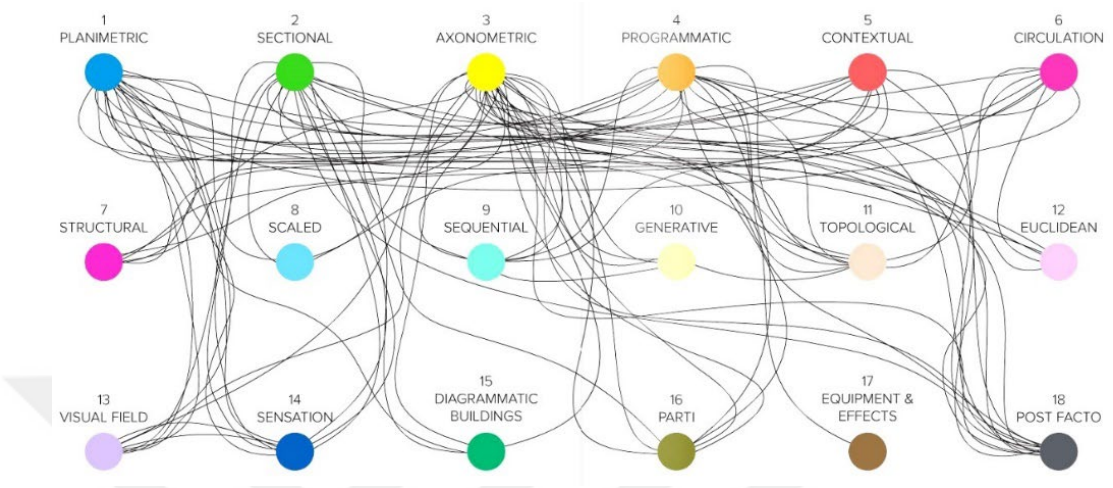

Figure 3.8 : Categorization of diagrams (Url-5).

However, although the examples given here appear as post-production, it is possible to determine a similar approach to developing diagrams during the design process. If we consider the diagram as a link between thoughts and reality, it is necessary to think of it as a unique phenomenon that is transferred to a two-dimensional plane and a new design dictionary is created. Diagrams in visual representation can be used as sketches and drawings, as well as a thinking medium that can now be used in digital media. This versatile and multi-representational structure of the diagrams shows that it has a decisive role in the design process. Considering the conceptual design stage, when words are structured and combined with lines, the diagram gains a two-dimensional physicality and imposes the action of categorization visually. Similarly, in the approach to the design problem, expressing the features of the space with sketches and combining them with various icons, symbols and similar visuals shows that the diagrams establish the decision mechanism in the design process. Diagrams like the aforementioned categories come together with other visual representation media in the architectural design process, removing the linearity of the design process and emphasizing the importance of drawing and sketching. Frascari (2011) mentions the scope, techniques and role of architectural drawing in the book Eleven Exercises in The Art of Architectural Drawing. Accordingly, the drawing contains many elements from detail to general, from plan to section, and even from stillness to flow. He says

that architectural drawing is based on the support of plan, section, elevation and perspective drawings and communication over the designed product. In architectural design, it is possible to define plan drawings as horizontal sections that describe the space, where the organization is made, offer different perspectives between scales, and where details and design decisions can be read. Plan drawings, which function as a mapping in the analysis of the context in the design process, reflect the ideas of the designer according to the meaning of the lines used in the conceptual design. Frascari emphasizes the position of the line in the drawing as follows;

> Lines are material, spatial, cultural and temporal. From a superficial reading of architectural drawings, the lines seem to describe buildings; they present to the reader a gestalt of the forces that determine constructions and uses. However, these forces are at work on drafting supports, these forces also exist outside of them and are free from time and matter. The lines describing a plan on a construction site or on a drawing are architecture's most fascinating puzzles since they make visible and tangible what is invisible and intangible to construct and to construct buildings. Lines present an entire building by simplifying its reality, but at the same time, they manifest an uncut view of the building's interacting parts by showing more of what is visible in the built reality. These lines present the invisible aspects of architecture, representing what cannot be seen once the walls are erected (Frascari, 2011, p.103).

Here, plan drawing establishes a thinking mechanism that provides hand-eye coordination and flows towards the physical environment. Thoughts poured into a paper or other medium cause different parameters such as scale, depth, program, border, infinity, relationship, and detail to be read from the plan plane within the framework of an architect's point of view. At the same time, as in diagrams, plan drawings are constantly being produced, renewing, and deforming themselves with other representations. In this case, it is possible to say that it establishes a direct relationship with cross-sectional drawings within the scope of architectural drawing. Dernie (2010) describes section drawings as potentially at the intersection of the relationship with the ground and the encounter with the sky. This description can be considered the main element that separates the section from the plan and also describes the approaches in the design process. In addition to factors such as light, depth, permeability, and thickness, it also represents the features of the plan. Details and relationships that change depending on the scale demonstrate a similar scheme between the plan and the section. This representation, which is more similar to human perception than the plan, plays a role in the distinction between inside and outside and carries clues about the atmosphere of the space. Sections, which can also be handled

like diagrams, exhibit a decision-making attitude in the relationship established with the ground. After the drawings describing the two dimensions, the three-dimensional drawings in which both the plan-plane and the section-plane are perceived appear as perspective or axonometric/isometric projections. Dernie (2010) emphasizes the importance of perspective drawings in the architectural design process by mentioning their scope within scale, structure, and material. However, he states that the main role of perspective drawing is decisive in testing the idea within the design process, establishing a dialogue between the project area and the designed structure and synthesizing all the information. Edwards (2008) also focuses on the layers, shapes, shadows, surroundings and the narrative built upon the perspective drawings and relates it to the photographic representation tools. This relation leads to the definition of storyboards and collages. Storyboards are based on perspective-based narration as well as describing a timeline. The actions, thoughts, perception of the space, atmosphere, dialogues, and situations describing the use of time in the design are the elements that enable the establishment of this holism and are included in addition to the perspective.

According to Frascari (2011), storytelling can be seen in each representation medium since architecture is embedded in time, space and event. Therefore, storyboards can be considered unlimited representation methods. It incorporates various design information such as diagrams but also presents the use of space by combining it with different representational media. While that flow can be read on a section drawing, this temporality and plot can be read with perspective drawings consisting of many frames and layers. Furthermore, by combining different materials and tools, these layers and frames can enable the establishment of abstract and concrete relationships. This situation has a significant impact on the atmosphere, life, movement, layers, and actors of the space that is designed as a result of the incorporation of the collage production technique into the architectural design process. Thinking about places using collage engages our material imaginations (Dernie, 2010). In this context, collages should be considered sketches that determine the design process. Collage, which is a representation medium where different layers such as real texture, photography, color, and drawing come together, plays an active role in describing the atmosphere, establishing the abstract-concrete relationship, creating a context, and making a design decision.

Models that make the design be perceived in three dimensions are as important as the drawings when the architectural design process is considered. They offer a thought scheme that works together with drawings or mental images. Working together, these representation media have different typologies that support the creative process. Dunn (2010) examines models in 4 categories in the context of architectural design. Accordingly, it is possible to examine the cognitive dimension of models, namely "descriptive, predictive, evaluative and explorative" models. As can be understood from the names determined by Dunn (2010), model production is included in the design in parallel with the actions taken and the goals established. In this context, descriptive models can be exemplified as models that are made to exhibit or show and provide a dialog, while predictive models are models in which details and situations are tested numerically, and evaluative models are models in which the design is tested qualitatively during the development phase. Beyond these, explorative models, which are decisive in the early phase of design, in other words, conceptual models are models where creativity dominates and the scale, material, shape, technique and details used experimentally take place. These models, which can be described as three-dimensional sketches, in which thoughts are transferred physically, enable the designer to experience complex thoughts by touching and experimenting. In this process of producing by experiencing; producing alternatives, ensuring the perception of complex ideas by abstracting and simplifying, establishing a connection with the reality of design, and acquiring different perspectives for changes are observed as the main objectives.

The main idea of external representations' functions is to perceive and to see the mental representations as an object of physical world. Therefore, because of design thinking and its purpose is for dealing and creating in physical world, designers tend to externalize their mental representations in both verbal and visual media. The bridge between mental and external representations is the designer activities that are used and triggered with verbal and visual media. These media are basically analogy and metaphors, mind mappings, cognitive maps, oral and textual reports, stories and narrations, prototypes and models, diagrams and, the most important one, sketching (Stacey & Lauche, 2005). The visual and verbal representation media discussed in the theoretical literature promise a wide scope. These include intertwined representation practices as well as transitions in the design process. The aforementioned transitions

reveal different uses of imagination in the design process. In this case, representation media gain new meanings through the concept of imagination. The researched verbal and visual representation models are synthesized within the scope of the thesis, and a holistic view is formed between production of representation approaches such as experimental, detail, concept, and research. At this point, it is observed that the design process consists of both external representation media and offers an environment that includes different design approaches. The purpose of this research is to understand and describe these environments in detail as well as to look at how intensely these environments were used during the design processes in the context of imagination (**Figure 3.9**).

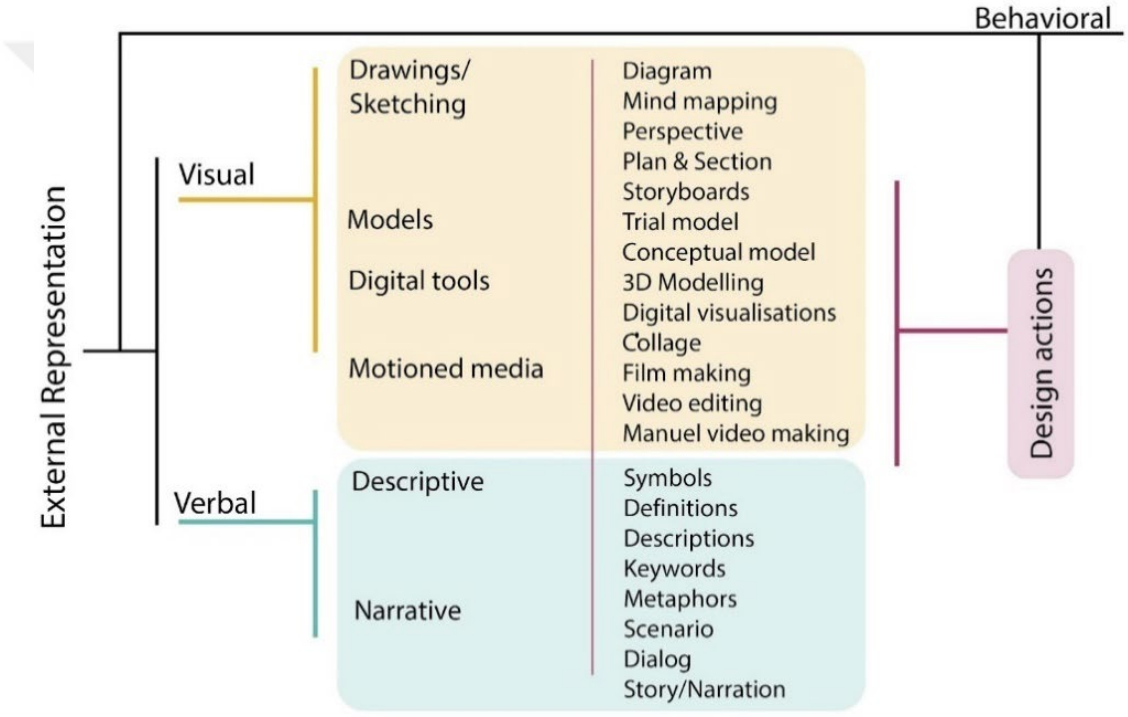

Figure 3.9 : External representation media (Adıgüzel, 2022).

3.2.3 Proposal for design actions within external representation

Design actions are considered as the behavioral content of the external representation. Design process is a set of representational and behavioral actions to approach a problem and find a solution. The design process, which is examined in problem space and solution space, can also be differentiated in this context. Atman and Bursic (1996) created a design activity coding scheme according to stages through an engineering problem solving task. In this experimentation, they code these stages as design activies to outline the design process with each step it can take from problem space to final

solution. In this case, the actions taken are related to the design process and are located in these spaces. Design representations act as a bridge between these two spaces and draw a route for design. The actions that establish the representations examined in the thesis are divided into action sets as “investigating the problem,” “analyzing the problem,” “generating concepts,” “generating spatiality,” “developing desing” and “communicating ideas”. The proposal for design actions presented here is nourished by the design processes discussed in the previous chapter and is formed by integrating the examples studied with the functions of imagination. As Goel and Pirolli (1992) discussed in their studies, design activities neither have certain patterns nor differ according to the designer, and it is inevitable that research should be done accordingly. Based on this context, the design problem is approached by considering the design actions explained in the context of imagination. Within the scope of the thesis, it is argued that imagination diversifies the design process or establishes certain commonalities so that design actions do not follow a certain order and depend on the approach of the person who imagines. Considering that the design process emerges when the thoughts in the mind or the act of thinking are externalized, it is also possible to follow imagination through representations. In this case, the design actions gain importance, and it is argued that they create a dialogue mechanism between the external and mental representation media, as well as between the problem and solution environments. The pursuit of imagination is sought in these relationships.

The actions performed by the "investigating the problem" action set are classified as "researching, experiencing, defining/describing and exemplifying" within the problem space during the design process. These actions, which define the moment of meeting the problem and the approach to the problem at the beginning of the design process, direct the design by being associated with the mental representation. Because this action set is located in the problem space and is within the scope of the design process as a problem structuring (Goel, 1995) and while it does not describe the intermediate situation, it has a directive effect on the action taken before or after it. At the same time, it is possible to say that it is in the same function set as activation, which is one of the mental representation actions. In this case, both mental and external representation appeared with these actions can support imagination and therefore creativity (**Figure 3.10**).

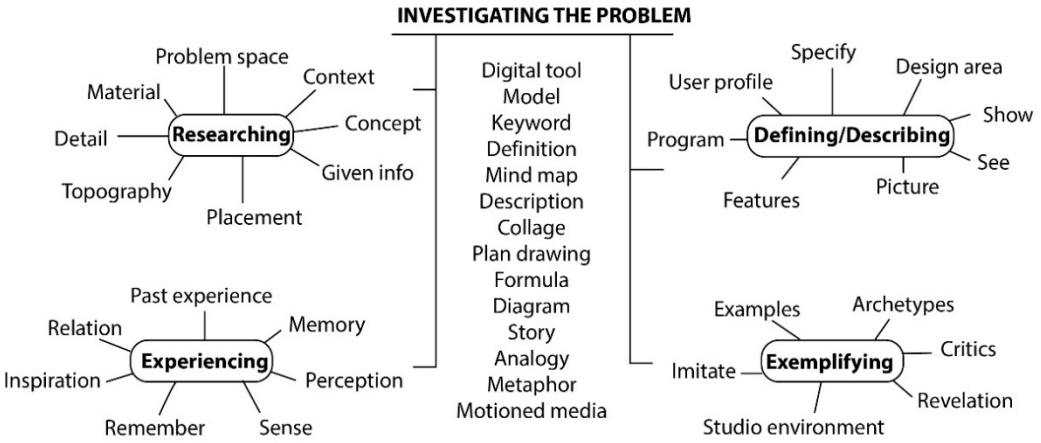

Figure 3.10 : Investigating the problem action set and related keywords.

The "Analyzing the problem" action set, which remains in the problem space and carries clues about the approach to the problem, includes the actions that help to dismantle the problem within the architectural design process (Cross, 1984). In this context, "connecting, organizing, comparing/choosing" actions define the set of actions for analyzing a problem and instituting relational integrity between problem space and solution space. The act of connecting ensures that the data collected in the context of the investigating action set are brought together and related. At this point, before the conceptual design or spatial design in the design process, the relationality that enables the formation of ideas and determines the main approach seems possible with the connecting action. Similarly, the act of organizing appears as the act of representation that enables the treatment of built relations as a structure. The organizing action, which provides solving the design problem and establishes the semantic integrity for the solution, acts as a bridge between the problem space and the solution space. Unlike the two actions, the act of comparing provides the revealing of the bilateral relations between the data discovered about the design problem. This process, which usually occurs after the exemplifying action, can also slide directly into the solution space. Because making a comparison between solution design and existing realities not only supports the approach to the problem but also improves the design with the references it gives. In this context, these three actions establish the associative function of imagination under the action set of analyzing. In this context, the associative function of imagination is included in the design by bringing together information, creating a concept, and establishing a relationship with memory, but generally as a combination. At this point, imagination can be thought of as whether or

not these analyses are made with a new and innovative approach under the name of novel thinking (**Figure 3.11**).

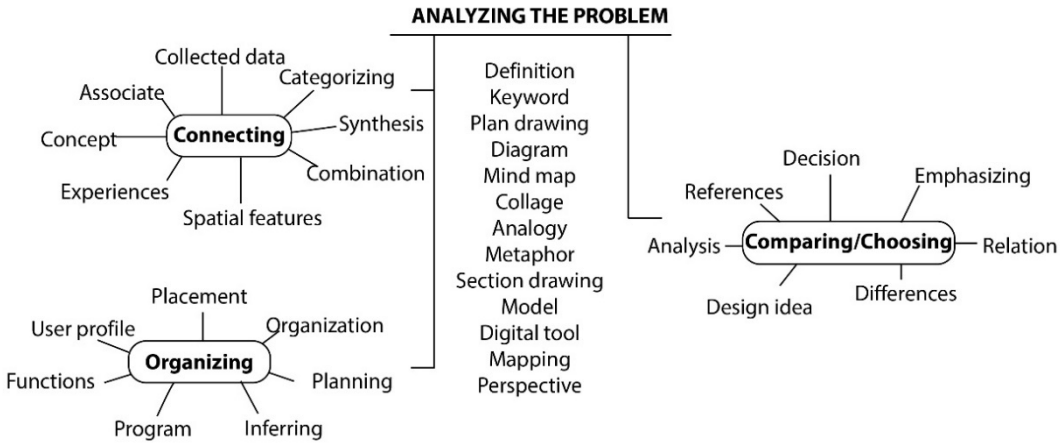

Figure 3.11 : Analyzing the problem action set and related keywords.

Cross (1997) in his work on "creative leap" emphasizes the role of concept production in decision making and transition to solution space in the design process. Accordingly, concept generation enables the designer to both direct the decisions taken and shape the design and bring novel approaches to the problem. “Emphasizing, setting principles, and differentiating,” which are under the “generating concepts” action set, can be considered actions where the first steps towards design and solution are taken, based on the relationships derived from the design problem. The act of emphasizing is considered a set of representations that nourish creativity together with the associative function of imagination since it reveals the themes that the design focuses on. Similarly, while design decisions or design principles define a decisive process regarding the concept, the action of “setting principles” is included in the design process in the decision-making function. These principles appear with both the associative function and the iterative function of imagination. Because setting principles can be described as the emergence of a novel decision when viewed from the representative approach, it also reveals a holistic scheme that defines how the decisions come together. “Differentiating” action, on the other hand, is an action that describes an approach different from the others. With this action, getting away from the existing information and finding the new one gains focus. Differentiating the design, concept, solution, or approach to analysis has meanings in both making an alternative production and producing the new one. In this context, the act of differentiating gains meaning in iterative function of imagination and is involved in

the creative design process. However, considering the relationship with mental representation, the transition between functions of imagination also provides a meaningful route and enables the creativity attributed to these actions to deepen (**Figure 3.12**).

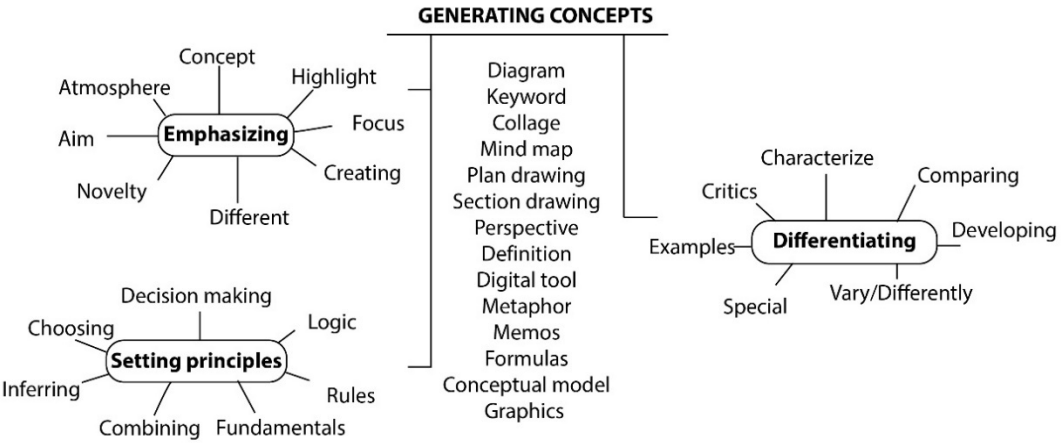

Figure 3.12 : Generating concepts action set and related keywords.

The "generating spatiality" action set includes the actions related to the creation of space in the architectural design process by being specialized. The actions taken in the architectural design appear as "forming, placing and experimenting" In the design process, the act of shaping the design, from two-dimensional geometric shapes to three-dimensional physicality, is examined as an action that covers all designers' approaches to architectural design. With the act of forming, where alternatives are produced and transitions from abstract to concrete ideas are possible, representations gain meaning, and iterative function of imagination gets its full response. At this point, design representations and actions are added to creativity in the solution space, and it also describes how an imagination scheme is formed beyond the production of the new by relating to the actions taken before and after. Similarly, the "placing" action is related to generating spaces and analyzing actions and is included in the iterative function of imagination. Representations of these actions can be followed both verbally and visually. However, forming and placing as the physical equivalent of the act of creating ideas within mental representation defines the main center of iterative function of imagination. "Experimenting," which is in the same action set, focuses on the perceptual dimension of the design process. Although trying various alternatives includes these actions in iterative function of imagination, it is possible to

simultaneously observe the effect of experiential function of imagination (**Figure 3.13**).

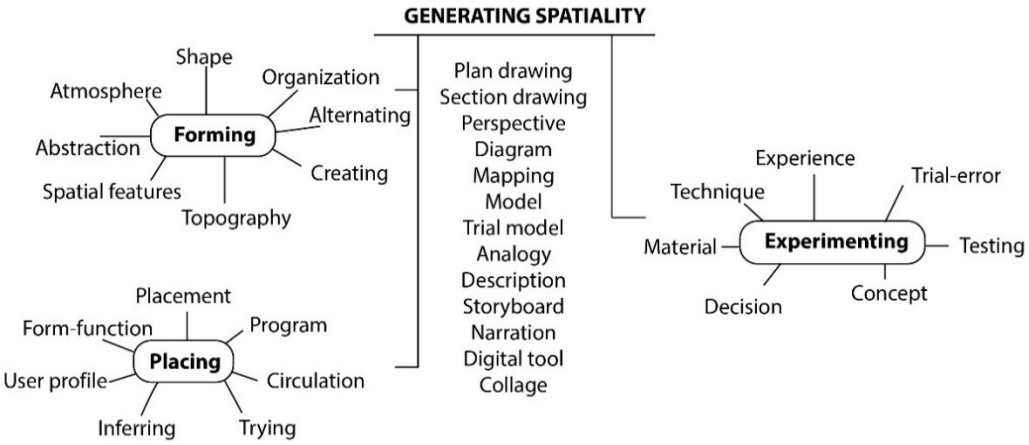

Figure 3.13 : Generating spatiality action set and related keywords.

"Developing ideas" describes a more singularized set of actions within the scope of imagination compared to other action sets. This comes into existence since the actions in the singularity are related to the transformative function of imagination. Design actions such as "testing, adapting, rearranging, changing, adding/removing" ensure that the spatiality or concepts established in the previous stages are changed or modified. Actions outside of testing use design as a potential for change rather than generating new alternatives. In this case, the transformative function of imagination becomes an important component of the design, placing the solution space within the context of an evolutionary process. However, the meanings of the representations made before or after can also appear as situations that direct these changes. When the act of testing is investigated, spatial characteristics are viewed as potential changes, such as when the modeling medium is used to test the design. It seems inevitable that the changes that can be made to the model will emerge with the testing action. However, if the act of testing is considered a communicating act, it is seen that it is included in the experiential function. Because during the testing process, the perceptions of the designer are activated. In this context, the representations used, and the actions performed describe a continuous process that supports each other. Although the thesis does not aim to argue that the design process is supported by continuous imagination, it is aimed to create a relational basis for the concept of imagination (**Figure 3.14**).

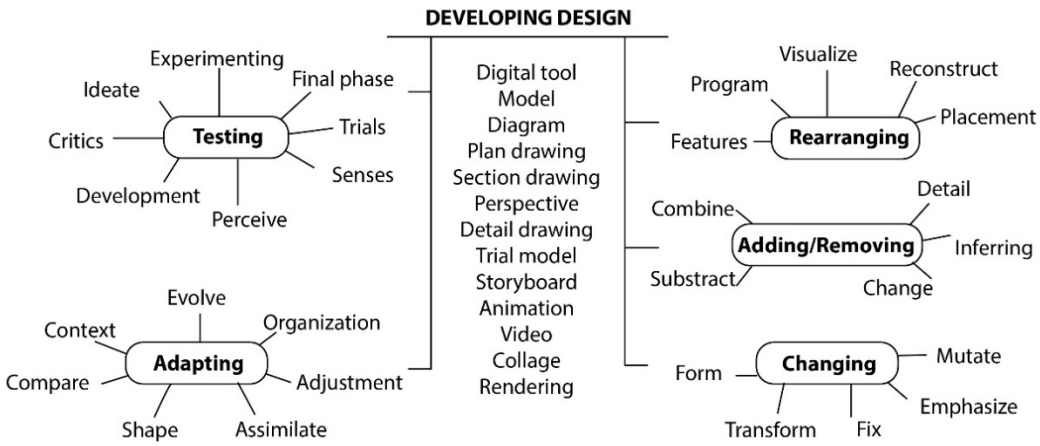

Figure 3.14 : Developing ideas action set and related keywords.

The architectural design process is strengthened by the dialogic feature of imagination. The dialogue established here can be explained by constructing a narrative by the spatial features established by the designer, and this situation can be supported by the basic elements of storytelling (Ampatzidou, 2014). The continuity established in the design process provides integrity with the "communicating ideas" action set. Actions analyzed as "narrating, animating and delineating" communicate both with others and with the designer himself. All three actions can be examined as the counterpart of experiential function of imagination and define the design process as an additional support mechanism by separating it from the main action sets (**Figure 3.15**).

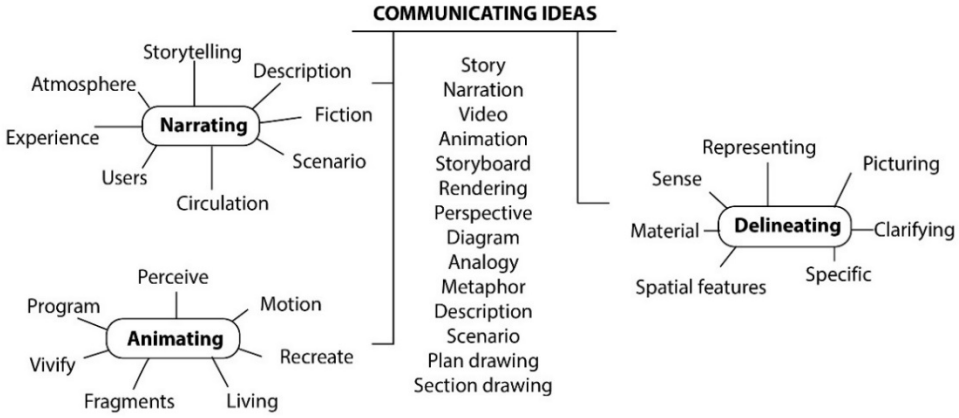

Figure 3.15 : Communicating ideas action set and related keywords.

This set of actions, which relates to daily life, the real world, and the designer's experiences, directly appeals to the narrative and the senses. These actions, which can be encountered in both the problem space and the solution space of the design, are evaluated within the scope of the thesis as the main outputs of creativity and spread to design process. These three actions, which can also be considered the physical

equivalent of the sensing act of mental representation, have an important place in architectural design education and support the interdisciplinary knowledge use and perception of design students. In this context, experiential function of imagination is dispersed into the design process and can be followed through the described actions.

The investigated design actions help to establish design thinking by identifying new associations. Because of the concepts with which they are associated, these action sets and the actions within them are connected to various functions of imagination. The created imagination function graph is used in the model to determine the thesis method in the context of external representation and design actions (**Figure 3.16**).

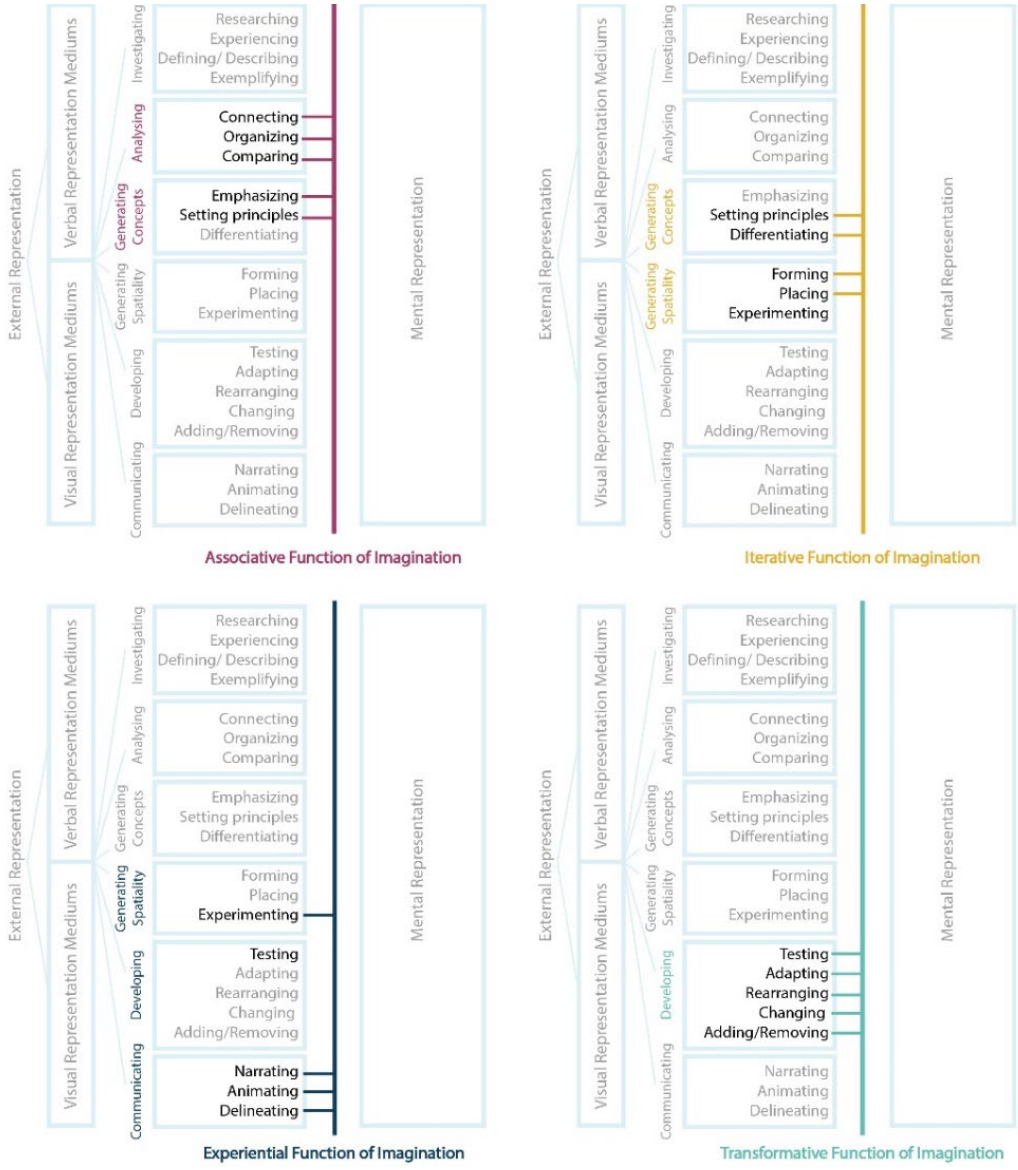

Figure 3.16 : Design actions and their relationship with imagination functions.

3.3 Conclusion: Bactracking to Imagination

Mental representation and external representation form a mutual relationship in the design process. On the other hand, imagination acts as a bridge between the two representations and attributes the design actions and four functions of imagination to the design process (**Figure 3.17**). Within the scope of the thesis, it is argued that imagination emerges in different forms in design process, and this can be followed through design actions. Although there are various mental representation iterations and models, imagination, which is consistent with schema theory, defines a process of processing information and producing new knowledge. At this point, the mental representation associated with memory ensures that new information is included in the design thinking, while the network it establishes allows the design thinking itself to be creatively structured. In this case, representations and actions between ideas and thoughts in the design process emphasize the functions of imagination and describe an approach to how imaginative thinking is used. The defined actions are matched with the thinking activity in the design process. Expansions on the design thought and design process discussed suggest that there is a connection between the mind and reality.

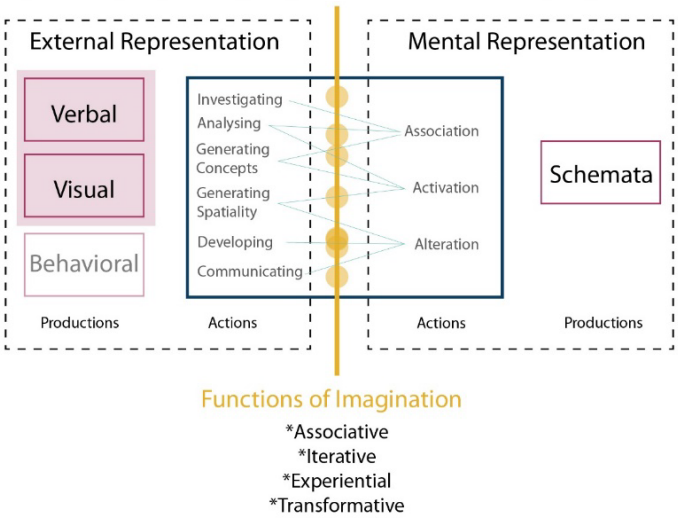

Figure 3.17 : Functions of imagination in-between representation media.

In external representation, which is considered similar to the approach in mental representation, imagination is matched with design actions. In this context, representation media that can be followed physically gain importance and appear as an inevitable situation that establishes diversity. The representations, which are divided into three branches, verbal, visual and behavioral, describe the design

approaches with different meanings but clarify their meaning with the actions taken. The thesis focuses on verbal and visual representations as representational media and actions that refer to behaviors taken while creating the representations and design content. In this case, design actions are grouped for not only providing the creation of verbal and visual representation media but also forming a basis for following imagination through design process. In this case, the emerging design process and its representation show the points where imagination functions are involved in design. When imagination is traced backward, it undertakes the task of establishing a dialogue between external and mental representation through design actions and charts the route of design approaches both as common patterns and as differentiating individual routes (**Figure 3.18**).

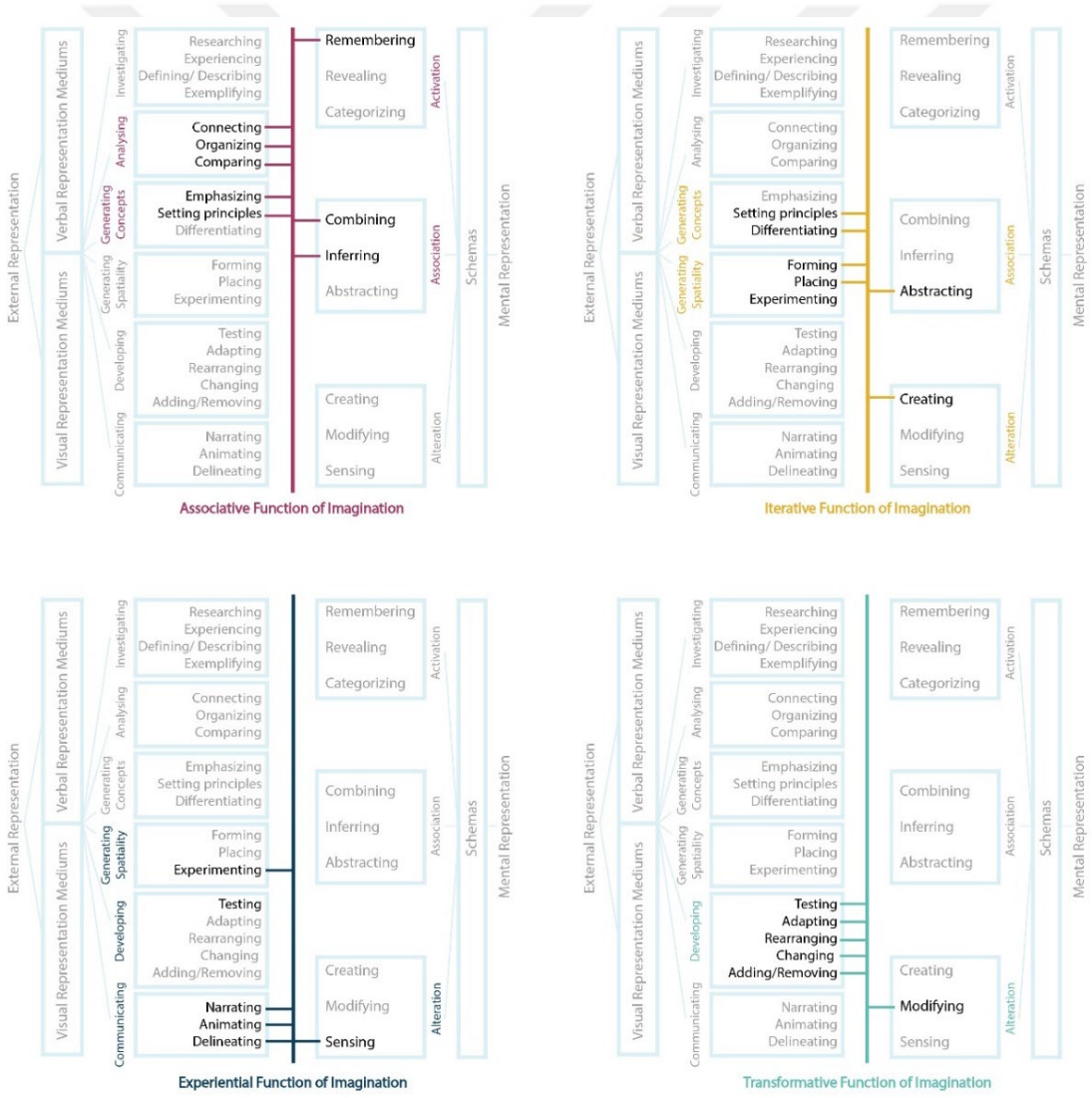

Figure 3.18 : Actions and their relation with imagination functions.

4. IMAGINATION PATTERNS

Within the scope of the thesis, the concept of imagination has been deconstructed through different approaches such as psychology, philosophy, neurology, and design. As a result of the research that was made in the previous chapters, the concepts related to imagination were determined and the place of these concepts in the design process was discussed; therefore, the scope of imagination was formed. The four functions of imagination, which are named "associative, iterative, experiential, and transformative", are explored through their relationship with representation in design process. The thesis aims to examine how imagination functions in various phases of the design process. In this chapter, representations used by architecture students will be examined in the first phase of case studies in the context of imagination functions through the design diaries they produce. Then, through in-depth interviews with the students, the design processes of the students will be analyzed with the structured model in the context of design actions and imagination, and it will be investigated how the four functions are included in the processes. In this part of the thesis, the method of these studies, data collection and analysis will be explained and then the findings from both case studies will be discussed. In this case, it is aimed to test and investigate the hypothesis, which states that the four functions of imagination are used in the design process and that they establish common patterns and common behavior groups in different approaches in architectural design education.

4.1 Methodology: Mapping of Imagination

In this part of the thesis, the methodology of the studies conducted to investigate how imagination is involved in the design process through representation will be discussed. The methodology of the thesis includes two case studies; design diaries and in-depth interviews. Case studies cover the project courses conducted with the students of Bahçeşehir University, Faculty of Architecture and Design, Department of Architecture in the spring term of 2020-2021. In the first phase of the case studies, the portfolios of the first-year students, under the name of design diaries, covering the

work they did in the ARC1002 project course were examined. By determining which representation media they use with what intensity and for what purpose, the existence of imagination is revealed with the examples taken from the design diaries. In the second phase of the case studies, in-depth interviews were conducted with first-year architecture students, in which they explained the process they went through in the project course, and the process that they did not transfer to the design diaries was examined more clearly. In order to understand whether there was any difference in the use of imagination, 4th year students of were included in the in-depth interviews as a comparison group. With the interviews, patterns and behavior groups on how imagination is included in design thinking were determined by mapping the design processes of the students in relation to the representation, design action and imagination function they use. In this section of the thesis, the data collection and analysis methods of these case studies will be explained in detail.

To begin with, in the first phase of the case studies, 40 design diaries prepared by the students in the project course called ARC1002 Design Studies were collected and contextually analyzed to reveal the representation tools used in relation to imagination. Since design diaries are considered a portfolio where they describe their work and design processes like a diary, they form a basis for the analysis of the process. Considering that it is desired to gain a habit of using representation methods in first-grade education, design diaries also make it possible to examine them as a comprehensive representation dictionary. Visual and verbal representation media described in the previous chapter were searched for in the diaries, and at what stage of the design process they used which representations, how often they used them, and how they interacted with their imagination were interpreted and analyzed. In the examined projects in their design diaries, they worked individually on the first project and designed a place/market for swapping, and in the second project, they designed an eco-village as group work. Following these two design processes which impose different methods through the design tools used gives information about the approaches in architectural education. As a result, the productions in the design diaries were coded according to representation media and the frequency of use of obtained datasets were graphed. The diversity of the design processes is demonstrated by supporting examples taken from the diaries. In this context, tracking was made through tools and actions, and it was associated with imagination. Thus, design actions and

representation media to be sought in in-depth interviews were determined, and their relationship with imagination was tested with the proposed model. Examination of design diaries reveals how the usage intensities and usage purposes of representation media vary with different imagination functions. With these findings, it was considered important to continue the in-depth interviews in order to map the design processes of the students in the context of imagination, in order to detail the determination of the differences and patterns.

The first phase of case studies has allowed us to establish a relationship between the students' representation media and their design approaches. Aside from that, the second phase of case studies is designed to investigate and map how imagination is involved in the design process. The thesis focuses on the design processes of first-year architecture students. The motivation of this study is that first-year architecture students have just started to use these representational environments in design practice, they built their own design approaches on these representations, their imaginations exist in a raw form, and they only received basic design education. The inclusion of the diversity of representation tools and actions in the studio works to provide design practice to the first-year students has an important place so that students can use different imagination functions. It is the discovery of the potentials of pursuing broad perspectives of the first-grade students. In return, the architectural design processes and approaches of fourth-grade students who have completed their diploma projects are developed and changed throughout their education. Accordingly, in-depth interviews were conducted with architecture 4th grade graduation students as a comparison group. The aim here is to determine whether there are significant differences in the use of imagination in the architectural education process and the changing situations in the design processes between these grade levels. Evaluation of the design processes of first and fourth grade students within the scope of case studies allows both comparison and evaluation of architectural education. In this context, representations and actions followed by different functions of imagination in the design process will make these evaluations possible.

In-depth interviews lasting between half an hour and one and a half hours were conducted online with first and fourth-grade students, who have different project scores. The demographic characteristics and interests of the students were investigated with the survey (Appendix A) they were asked to fill out before the interviews. Semi-

structured in-depth interviews with a total of 22 students were included in the thesis anonymously. The distribution of the students was included in the interviews as 12 females, 2 males from the first graders and 4 females and 4 males from the fourth graders. With the semi-structured interview technique, pre-determined questions are asked to the participant by changing the order according to the course of the interview and the answers received. In this technique, which provides a flexible interview, the researcher can add or remove questions to elaborate answers or focus on themes. In this way, more comfortable communication is established with the participant (Smith, 1995). Based on this information, a set of questions for the interviews was developed. The questions asked were structured from general to specific (Appendix B), and they were expected to describe the design processes they had. Questions asked by focusing on representation tools and design approaches used by students in their design processes reveal how students incorporate their imagination into their designs.

The interviews aim to reveal the design processes of the students within the scope of the architectural design course in the spring term of 2020-2021. For the students of ARC1002 course, the project focused on in the interviews, the Stop and Swap project (Figure 4.1), is a public swapping place produced by one of the four modeling techniques given for the area determined by the students themselves. This project, in which abstract and concrete thinking were processed together, was carried out two days a week in the online environment due to the pandemic conditions.

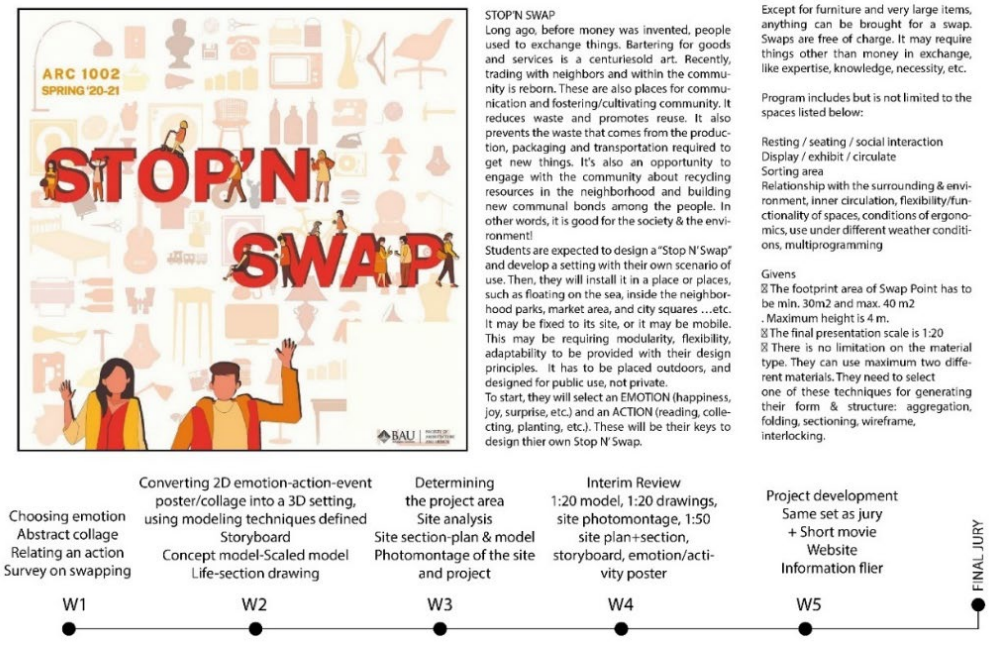

Figure 4.1 : ARC1002 Design Studies Project Syllabus.

Similarly, in the ARC4002 Graduation Project course, which was held online and lasted for 14 weeks, fourth-grade students were asked to design a technology museum by choosing one of the designated areas in Maçka or Tepebaşı (**Figure 4.2**). The students decided on the scope and content of the technology museum, and they are expected to cover it comprehensively from concept to detail.

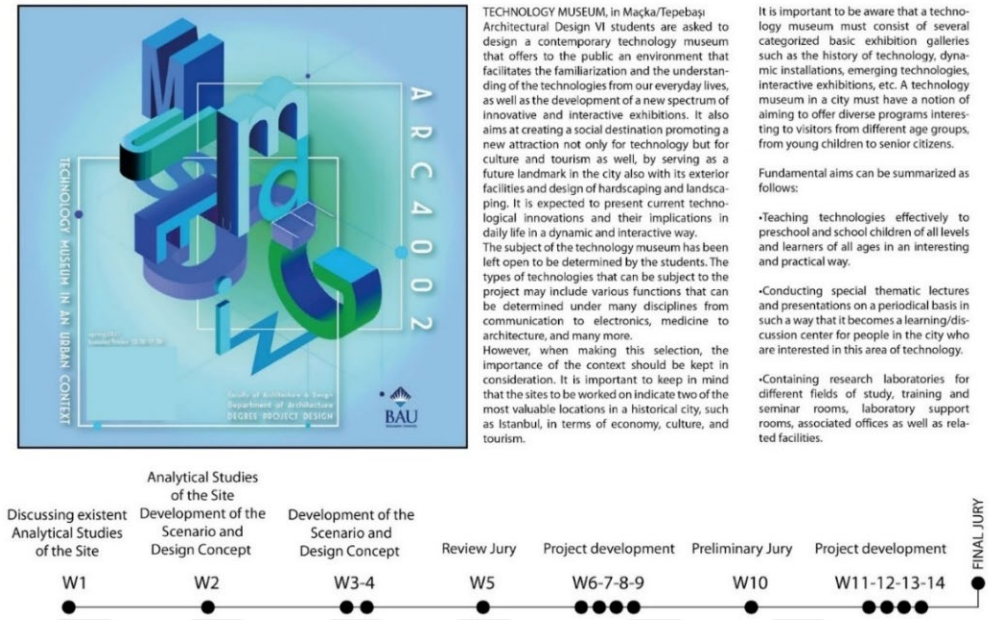

Figure 4.2 : ARC4002 Graduation Project Syllabus.

Interviews with students were transcribed for analysis. In this context, the process of creating students' imagination mappings which consist of word clouds, imagination function density graphs and design process charts used in the analysis of the collected data and the examination of the findings will be explained in this part of the section. First of all, "word clouds" were created according to the density of the keywords used in the interviews to reveal individual design approaches. With word clouds, the actions, concepts, keywords, various inputs and outputs used by students were included in the analysis as a diagram, and concepts focusing on individually created design routes were revealed.

The method used to create imagination function density graphs and design process charts can be explained with the thesis model created in relation to the previous sections. Imagination functions determined in section 2.3.2 reach significance in mental and external representation with the features they contain. Mental representation is discussed through schema theory, and mental actions in the formation of schemata are examined in detail in section 3.1.3 and associated with functions of

imagination. Since what is represented in the minds of designers cannot be tested, the actions included in the model in the previous chapter were considered supporting elements. At this point, mental actions activate schemata and interact with external representations. In the interviews, traces of mental representation were sought together with the act of thinking. In this case, discourses in the interviews in which students revealed their thoughts enabled the tracking of mental representations. Similarly, external representation in design is examined in section 3.2 in terms of tools and design actions. External representation contains various inputs and therefore its use in design is diversified. In this context, as will be explained in the first phase of case studies in section 4.2, the design diaries are decisive in discussing the external representation media and design actions. Interviews were coded by searching for the words to which the representation media and design actions corresponded. In this way, it has been revealed how and when the representation tools took place during the design process, with what intensity they are used, and which ones are significant. The actions that representation tools are used with are explained in section 3.2.3 and corresponding words to these design actions are included in the analysis as codes. As a result of the coding and analysis of the interviews, the design processes of the students were mapped with these actions, representations and imagination functions. The analysis of the interviews continued with the exploration of imagination functions associated with the actions during the design process. In this way, the distribution of functions of imagination used in individual design processes is also revealed. The individual percentage graphs created to understand the intensity of the functions of imagination used enabled the grouping of design approaches. These graphs were interpreted and evaluated together with the findings obtained from the interviews.

The intention here is to reflect the design processes through students' decision-making moments, the design processes they focus on, and situations of generating and developing their projects, as stated in the interviews. Design process charts were developed using the codes received from interviews in order to evaluate the students' design processes related to their imagination. When making the chart, lines were drawn for each of the four functions of imagination and situations not related to imagination. The processes/situations that analyzed from the interviews and were believed to be critical in the design process are depicted in the chart, together with the actions and representation tools to which they are linked. The determined actions are intersected

in the chart with imagination function they are connected to. These charts and graphs allow students' imagination mappings to be seen throughout the entire design process. It is thought that as well as common patterns of imagination can be followed from the mappings, common behavior groups of imaginative approaches will also emerge. Word cloud, imagination function density graph and design process charts were produced separately for each of the 22 students (**Figure 4.3**). This tripartite research and analysis revealed findings that support each other. In this case, backtracking is provided through the concept of representation regarding the place of imagination in the design process.

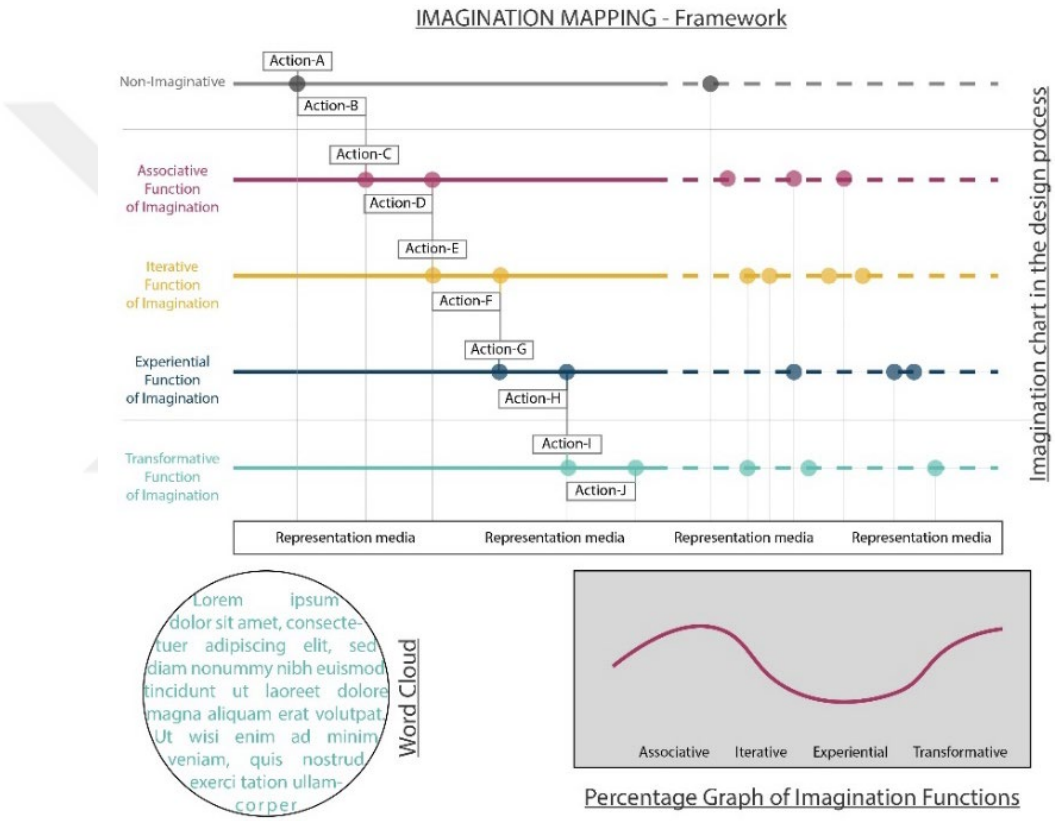

Figure 4.3 : Imagination Mapping Framework.

Tracking imagination backward in the case studies reveals that the intersection of design actions, external representation media, mental representation, and the functions of imagination together establish a route in the design process. The thesis model, which reveals the relationship between imagination and representation, helps to explain the analyzes based on case studies, and the design processes of the students are deciphered by searching for design actions in the interviews. The goal of this research is to uncover common patterns and common behavior groups established by imagination in the design process. Thus, how imagination affects the design process, its place in

architectural design education and how various inputs interact with imagination will be discussed. In this context, the role of imagination in design thinking is discussed by following design routes through representation within the framework of the use of imagination functions of the 22 students interviewed and in the traces of 40 design diaries examined. At this point, findings were obtained showing how the use of imagination took place in the design processes of first-year students, both through their design diaries and interviews. However, it was possible to compare the use of imagination of first graders with interviews with 4th grade students. In the following sections of the thesis, these findings on the use of imagination will be explained under the names of common patterns and common behavior groups. (**Figure 4.4**).

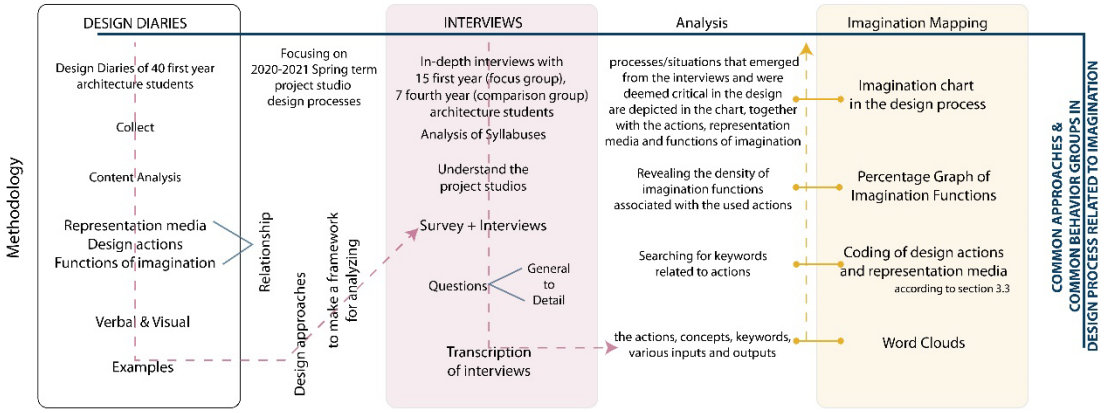

Figure 4.4 : Methodology.

4.2 Case Studies Phase I: Design Diaries to Analyze Representation Usages

The scope of the relationship established through the tracking of the design process under the influence of imagination, representation media and design actions was explored in the first phase of case studies. With the study, design diaries of 40 first-year architecture students during their Design Studies course held in 2021-2022 spring semester were analyzed and the representations in these diaries were examined. In this way, students' use of visual and verbal representation media was observed throughout the design process. As a result of the analysis, the representation media used in each design diary were determined and their usage densities were determined (**Figure 4.5**). Distribution of representation media according to the projects in the design diaries shows that design processes differ, as well as the existence of similar approaches. Imagination, on the other hand, is followed in relation to the representation media and the design actions to which it is attached.

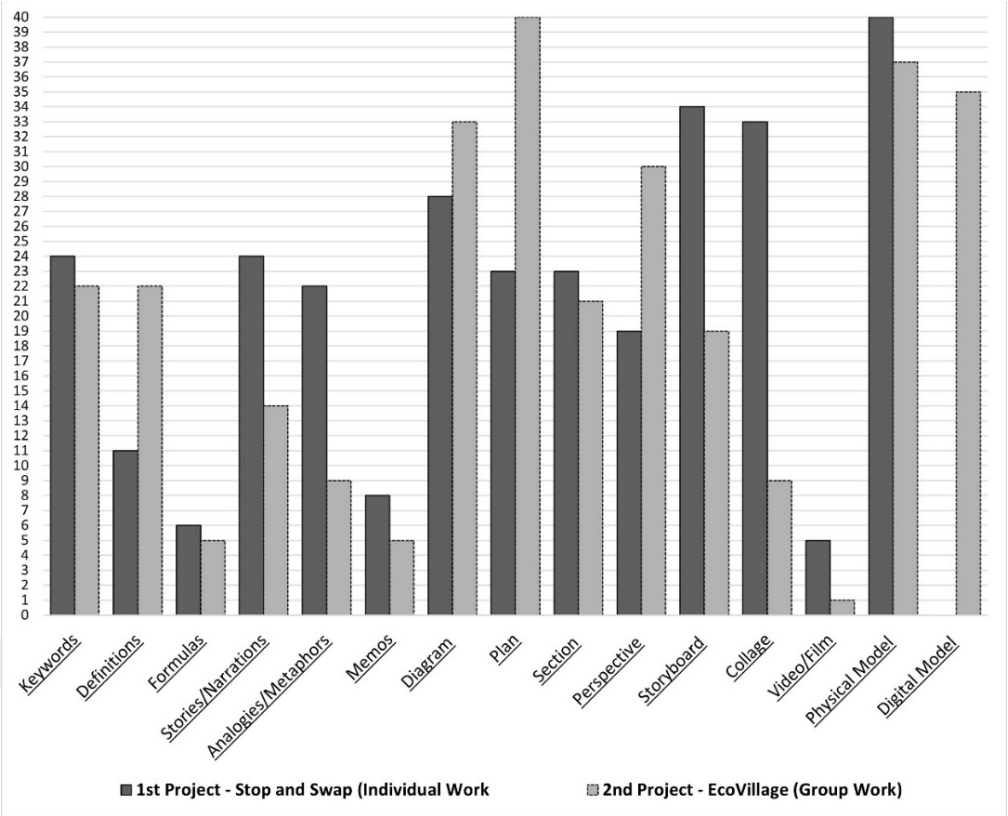

Figure 4.5 : Usage intensities of representation media in design diaries.

As can be seen from the graphics (**Figure 4.6** and **Figure 4.7**) of coding of representation media used in students' design diaries for the projects, there are different concentrations among the representation media. In fact, this situation differs even for two separate projects. However, the point of attention should be evaluated as the diversification of the representation media used. The diversification here is seen as an effort to expand the representation practices of first-year architecture students. However, the guiding effect of the practice of representation in the design process intersects with the different functions of imagination. The usages of representation media are related to design actions taken during the design process. While these actions are revealed in design diaries as steps that enable decision-making, they also appear as actions that cover the process and characterize the development of design ideas. In this case, the graphics produced as a result of the analysis of the design diaries refer to the use of representation tools, while also pointing to the purpose of use and the variety of actions used. The verbs specified in the design diaries are effective in revealing the actions. In this context, external representation media and design actions were categorized and took place in the thesis model to provide a backward tracking to imagination in design process.

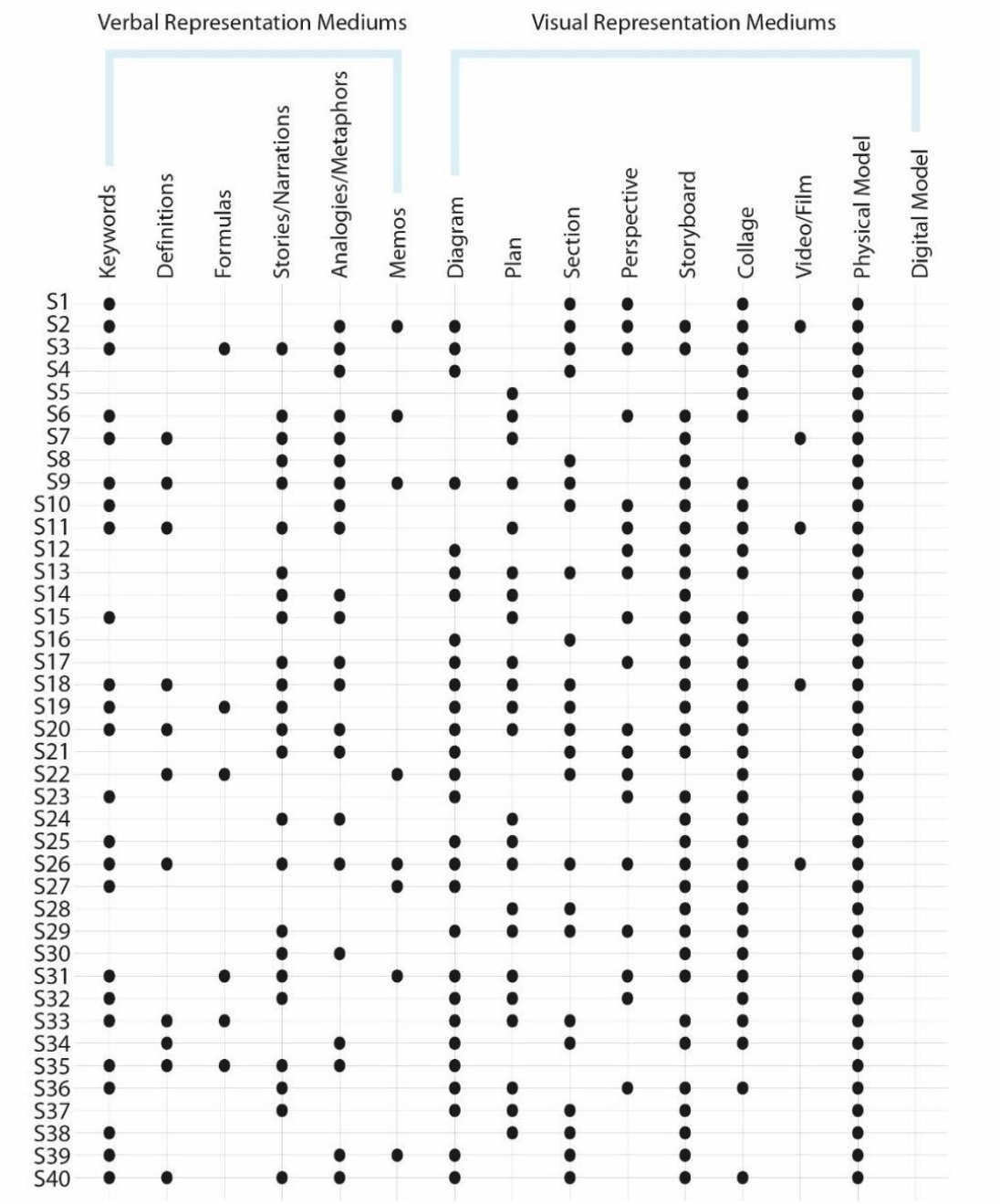

Figure 4.6 : Coding of representation media used in students' design diaries for the first project.

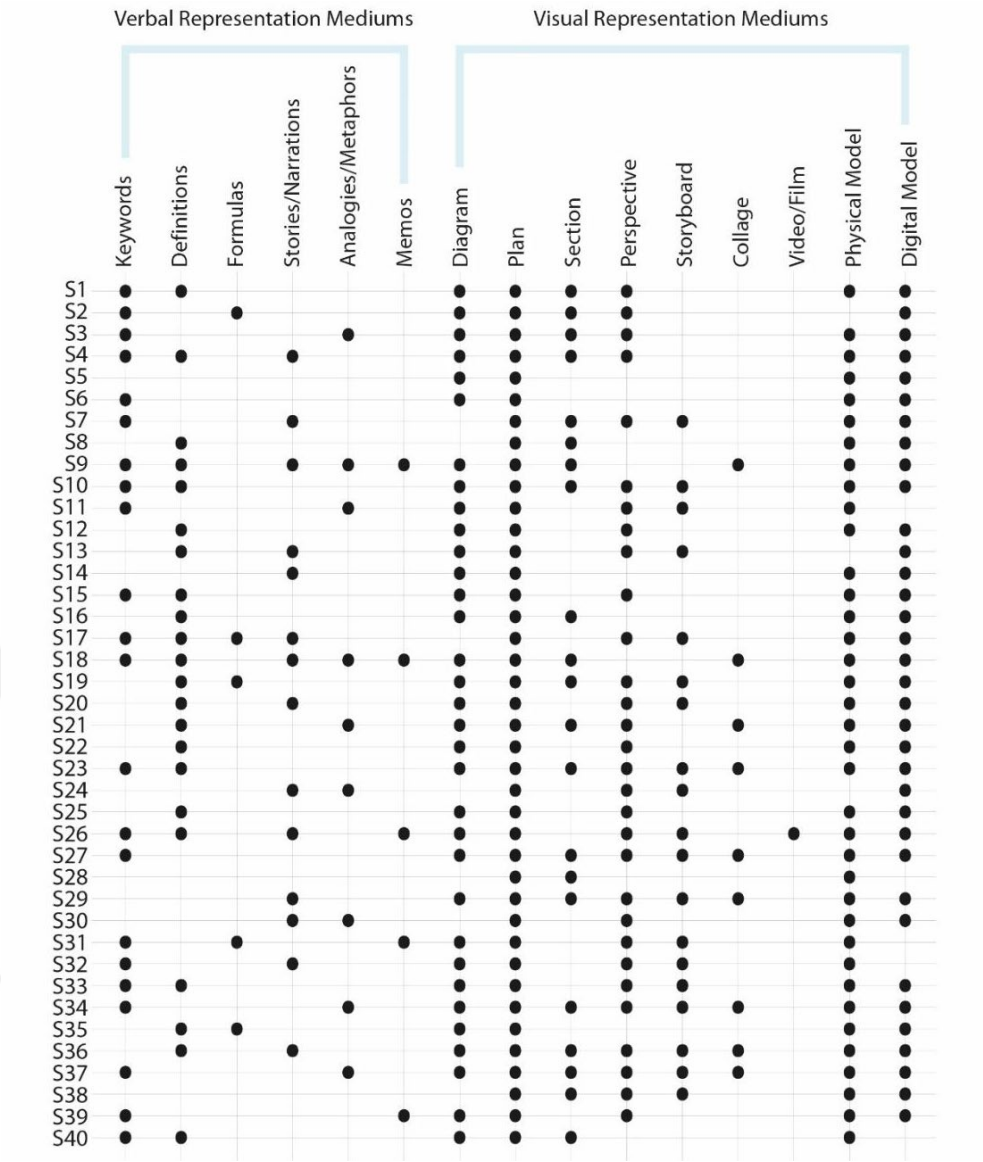

Figure 4.7 : Coding of representation media used in students' design diaries for the second project.

It has been understood that design process describes a non-linear flow without definite boundaries, which is based on the dialogue between mental representation and external representation. At this point, the design process gains meaning, diversifies or creates a pattern with the actions and design practices it includes. However, the crucial thing in this case is with which design action this representation media is matched, and thus with which function of imagination it is triggered by. In the next section, the relationship between visual and verbal representation media and their relationship with imagination will be discussed through examples elicited from design diaries, and a scope will be created for the next phase of case studies in which design processes are examined through representation and design actions.

4.2.1 Verbal representation

The verbal representation media and its relationship with imagination was revealed with the content analysis of the design diaries of students. When we look at media where verbal representation takes place in written form or as speech, it is seen that keywords, definitions, formulas, narrations, analogies and metaphors, and memos are frequently used in design diaries. Although different verbal representation media can be found in design processes, the research on this case study is limited to these six representations based on the data obtained from the design diaries. Each representation medium was analyzed in the context of its relationship with imagination through the examples taken from the design diaries.

Keywords were examined as one of the first verbal representation mediums that attracted attention because they were used in design diaries to convey their own design processes. When the keywords seen in the design diaries were examined, it was determined that they were used by the students to create the conceptual approach in both projects. The fact that it is used by the same students at a similar rate (**Figure 4.8**) in both projects shows that designing with keywords can be a common behavior or design approach.

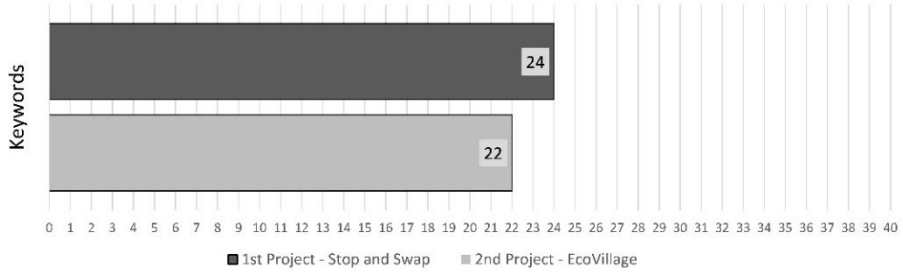

Figure 4.8 : Graph of keywords usage intensity in design diaries.

Accordingly, while abstract concepts can be used as keywords in design at the conceptual stage, concrete concepts that focus on problem-solving come to the fore in the stages where the design idea begins to take shape spatially. In this case, keywords can act as a filter in the problem research process, can be a planner in gathering information, can carry traces of abstract concepts and atmosphere, and can be considered a dictionary showing concrete design information. However, keywords cannot be used to complete the entire design process and should be regarded as a medium that supports other verbal and visual representations. Imagination can show itself intensely in the use of keywords. Depending on the purpose of using keywords,

which of the four functions of imagination takes place can be followed through design diaries during the design process as shown in the examples with various design actions (**Figure 4.9**).

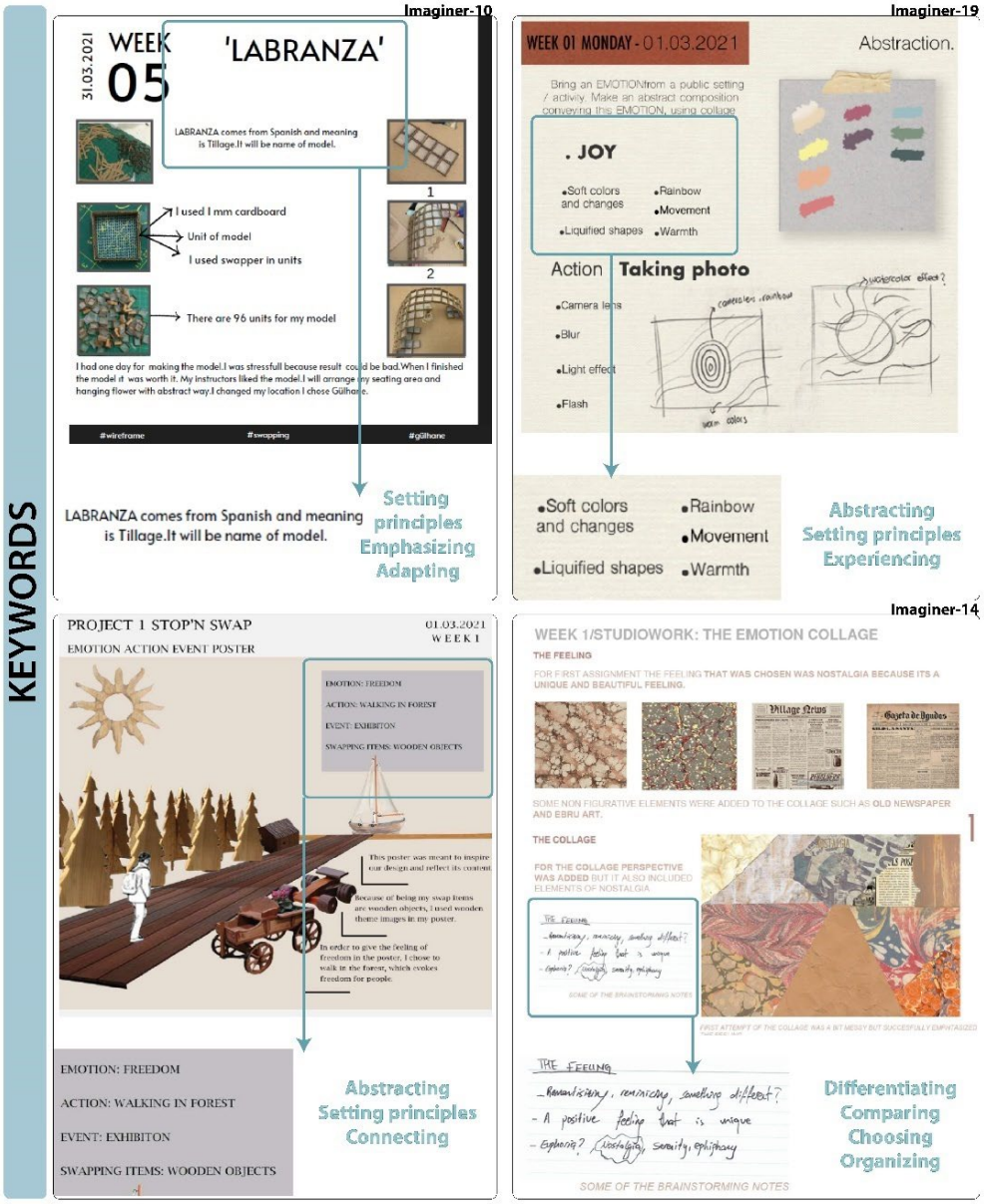

Figure 4.9 : Examples of keyword usages in design diaries.

Furthermore, noting the words/keywords with abstract meaning can refer to the iterative function of imagination in the design process. The use of keywords to describe the physical features of the designed space manifests itself in an interrogative process, and the causal changes in the description of the physical features emphasize the transformative function of imagination. Scenarios and design decisions built on keywords in the conceptual stage reveal associatiove and experiential functions of imagination. Accordingly, it is seen that the students planned the process and

concretized their designs according to the words they determined step by step. This representation medium, where examples can be multiplied, can also be used in combination with other representations.

Definitions are seen as sentences that reveal the description of the problem, the decisions made for the solution, and the spatial characteristics of the design ideas. Considering that it serves for the representation of more elaborated ideas in the design process, it can be followed as sentences with concrete meanings in defining the problem and explaining its solution. Considering the usage intensities in the design diaries, it is seen that the use of definitions has increased since the students continued their design processes with defined rules and research requiring definitions in the second project (Figure 4.10).

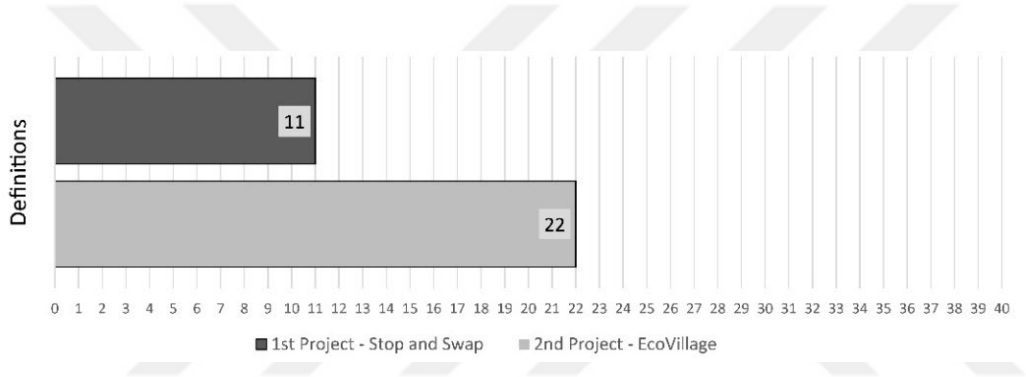

Figure 4.10 : Graph of definition usage intensity in design diaries.

The significant observation here is that definitions are mostly used in concrete expressions and final decisions. At this point, definitions function to convey problems or solutions to other people. This representation medium is formed by actions such as researching, describing, organizing, forming, emphasizing, etc. Definitions that improve each other with other representational environment have a dialogic character as they collect and convey the decisions taken during the design process. Considering its relationship to imagination, definitions can be viewed as a guiding and descriptive representation medium for the decision-making mechanism. In this framework, definitions incorporate different functions of imagination into the design according to their intended use. The symbols, words and sentences used in the explanation also define how the design is interpreted. It intersects with other forms of verbal representation as shown in examples; it can have a descriptive character with metaphors, a decisive function for form with mathematical expressions, or it can be for telling a story based on the meaning it carries (**Figure 4.11**).

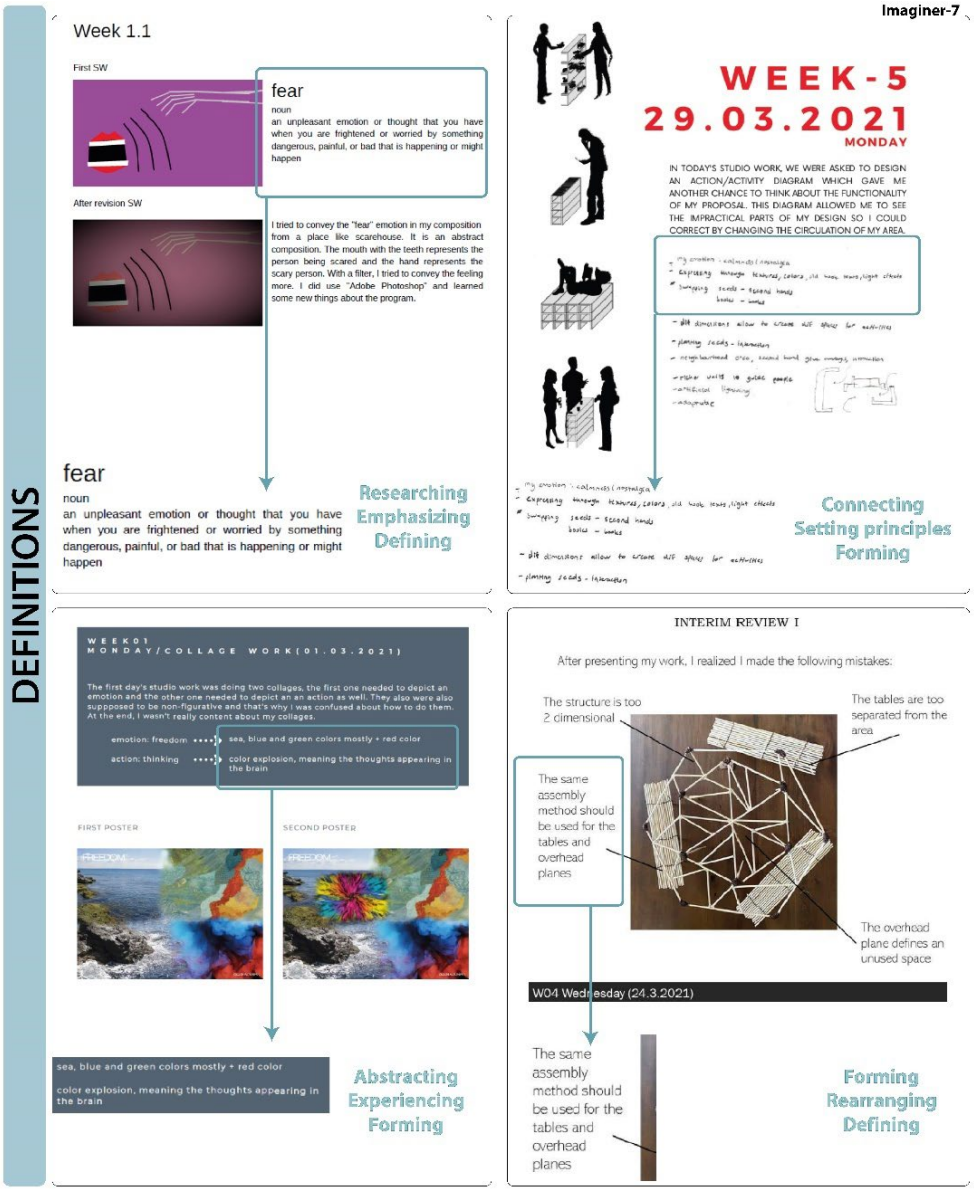

Figure 4.11 : Examples of definition usages in design diaries.

Analysis of design diaries reveal that the formulas are a concrete part of the design process. Although a small number of students use formulas (Figure 4.12), technical drawings, plans and designs they make with geometric shapes require the use of formulas, albeit mentally.

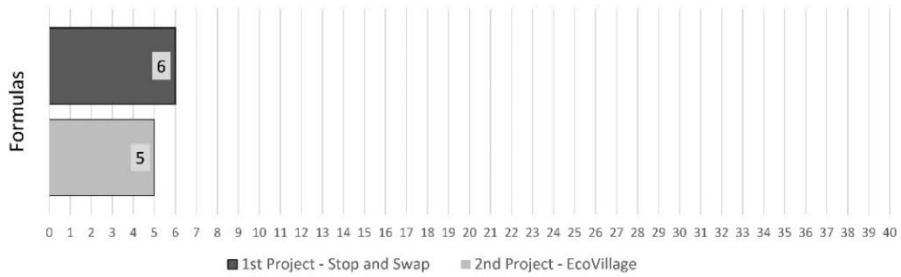

Figure 4.12 : Graph of formula usage intensity in design diaries.

Formulas are employed to develop design solutions that use mathematical expressions that support definitions and rules. At the point where spatial correspondence occurs, formulas and mathematical expressions enable the design idea to develop within the framework of calculations related to scale, shape, material, size. The use of measure and scale in plans and sections, calculations, parametric design rules, and determining mathematical and geometric rules appear in the design process, especially at the stage of design development. This examination reveals that formulas play a significant role in imagination's transformation function. In the design process, formulas find geometrical equivalents and coexist with drawings, and they must be examined in multiple contexts (**Figure 4.13**).

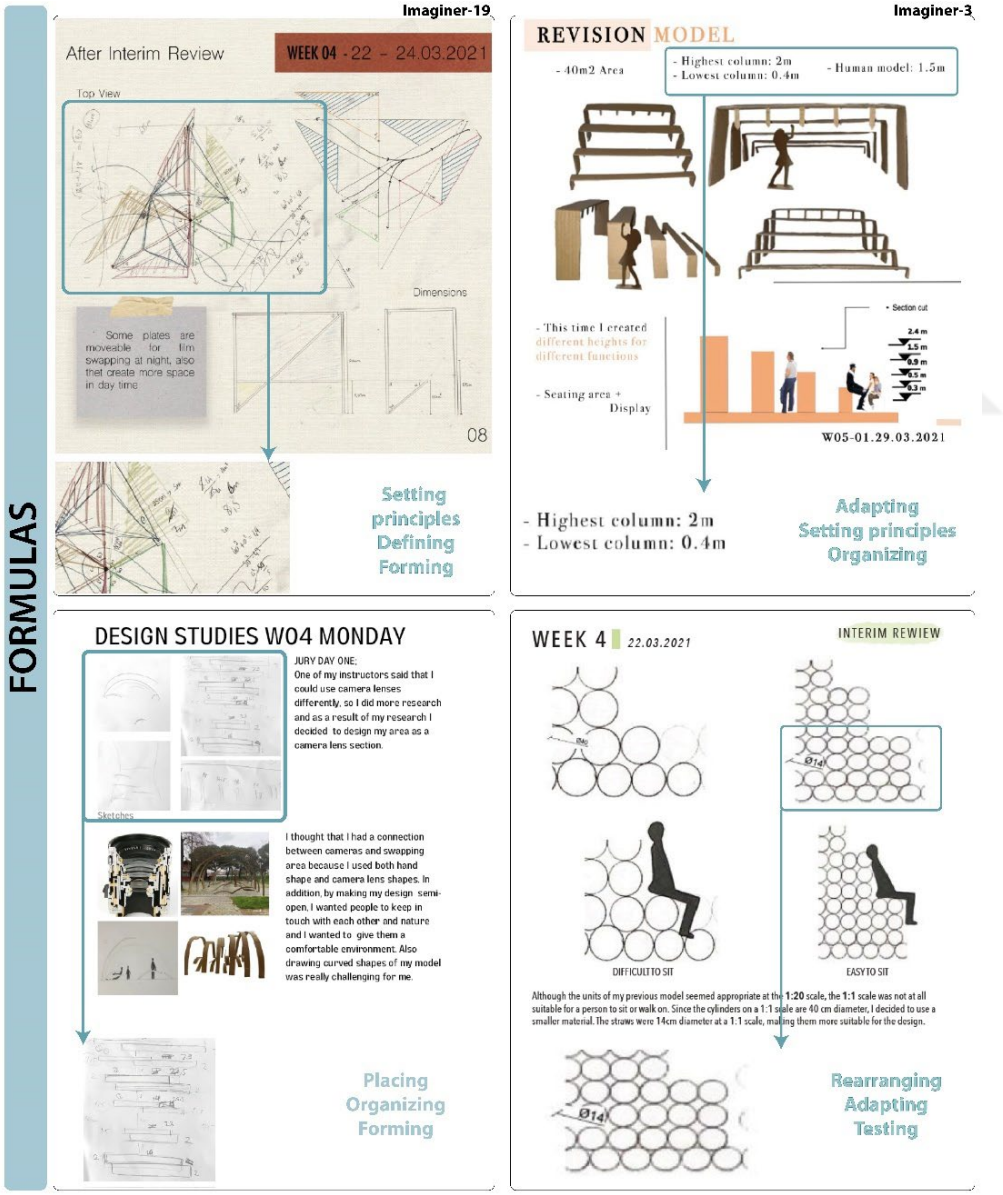

Figure 4.13 : Examples of formula usages in design diaries.

Reminder/memos are also the reflection of inner speech in external representation. Memos, the same as definitions, can be thought of as a representation medium that establishes a dialogue between designer's thoughts and physical world. At this point, memos use the dialogue built by the designer with his inner voice as a reminder. It is thought that the reason why the use of reminders does not seem intense (Figure 4.14) is because they did not put their plans and notes they took in their design diaries. However, it is possible to conclude that most of the students do not transfer their thoughts and the information they need to remember to external representation.

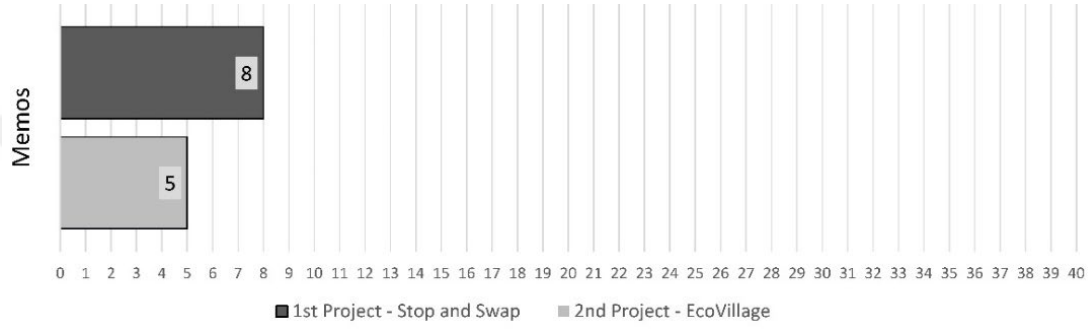

Figure 4.14 : Graph of reminder/memo usage intensity in design diaries.

Its content acts as a reminder in the form of questions, tasks or keywords. In this context, memos also represent actions in which the design problem or solution is questioned, the work to be done is organized and the situations to be focused on are emphasized. Although it is seen as a representation medium that cannot be discussed in design education, it is seen that it emerges in the process of examining design individually. In this case, it is possible to follow how the designer controls the design process and what is focused on. Represented phenomena can be considered a creative representation medium because it creates a physicality that can be observed concretely while making a design decision, where alternatives are questioned, and memories are attempted to be remembered. As the name implies, "memos" that emphasize remembering are linked to imagination through the relationship that memory initiates. The use of the associative function of imagination by keeping the memory in a questioning position, or the representation of multiplicity formed under the name of iterative function of imagination when ideas about design are questioned, can be externally followed by the existence of the memo (**Figure 4.15**).

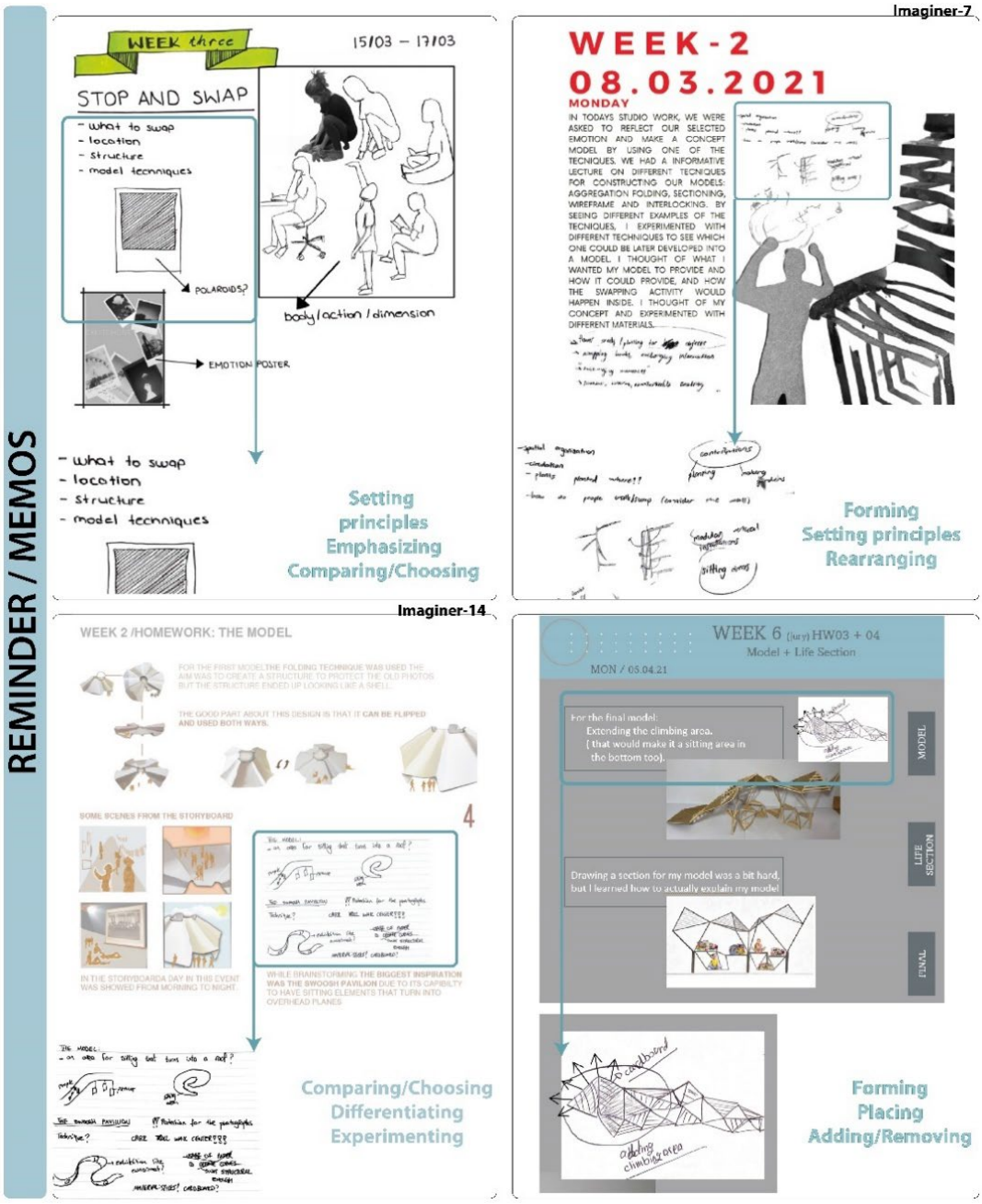

Figure 4.15 : Examples of reminder memo usages in design diaries.

Analogies and metaphors are included in the design process, unlike the previous ones. They manifest themselves as an abstract approach to creative design thinking. While analogies and metaphors can be defined as comparisons between words in linguistics, when they are used in the design process, they establish a connection between lived experiences and the design idea. The important point here is that, in addition to the other representation media mentioned, metaphors and analogies can be examined as a specific practice and ability. Analogies and metaphors can also be examined as visual representation media, but it is seen that they are used as verbal representation media

in the design diaries examined within the scope of the thesis. Considering the intensity of use (Figure 4.16), it is seen that analogies and metaphors have decreased significantly in the second project. The reason why it is used more in the first project is the importance of emphasizing the conceptual design phase and using past experiences as a design approach in design education. In this case, it is understood that students use analogy and metaphors in both form and concept design processes depending on the conceptuality and freedom of the project subject.

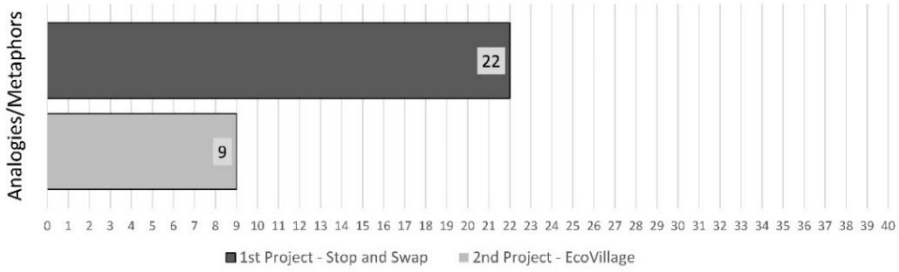

Figure 4.16 : Graph of analogy/metaphor usage intensity in design diaries.

Metaphors and analogies establish a relationship between the real world, design problem, and its solution. If we look at examples from design diaries, analogies and metaphors can be treated together with visual representations or other verbal representations. It is involved in the process by relating to emotions, experiences, information existing in the mind and to describe and construct a narrative. These uses, which appear in the form of simile or description, also support the decision-making mechanism in design process. While the relationship between imagination and metaphors is discussed in many sources, it is seen that there are relationships with different functions of imagination during the conceptual design phase within the framework of the examined design diaries. Analogies and metaphors are seen as an important aspect of the creative design process. The concept of creativity, in which the new and original is sought in the design process, can be strengthened by the relationships established through analogy and metaphors, and it is observed that the phase in which most students strengthen their design begins when they establish these relationships. This representation media, which can be associated with the four functions of imagination (associative, iterative, experiential and transformative), takes part in the process to develop the design idea and interacts with other representation media (**Figure 4.17**).

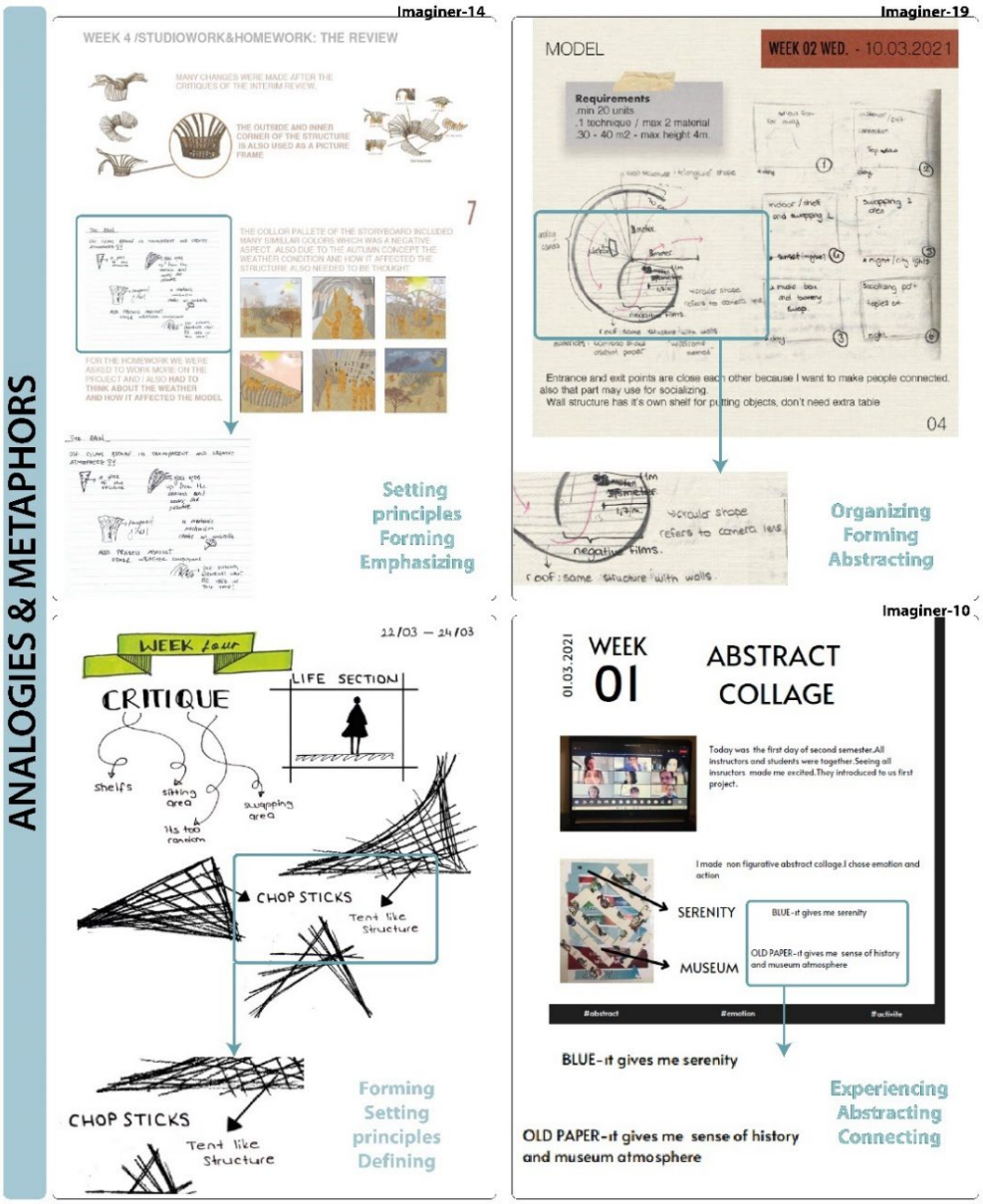

Figure 4.17 : Examples of analogy/metaphor usages in design diaries.

One of the verbal representation tools, narratives, plays an important role in the architectural design process. Storytelling is considered a subcase of narrations, and both are examined together in the thesis. The presence of narratives in the design process is seen as inevitable within the scope of architectural design, with their explanatory, perceptive, and narrative features that verbally convey a series of events. It is thought that the use of stories/narrations in the design diaries is more intense in the first project (Figure 4.18) because the project studio setup is focused on the students' own traces of their own lives. In this case, according to what is required in the project, there is a possibility of use that is included in every stage from the selection of the project area to the creation of the concept and the presentation of the project.

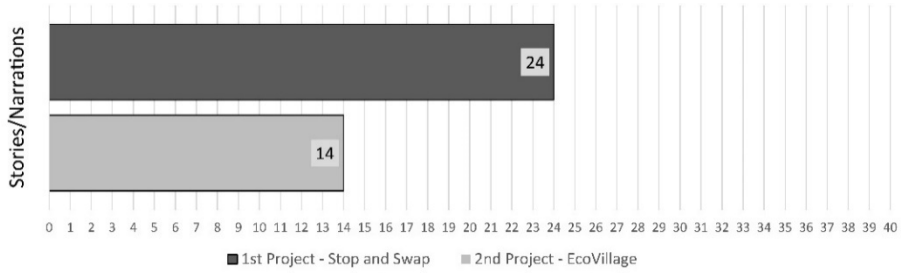

Figure 4.18 : Graph of stories/narrations usage intensity in design diaries.

When design diaries are examined, it is observed that narratives function in perceiving the design problem, convey the problem and the solution, and feature as a testing mechanism while making decisions for the solution. This verbally expressed representation medium can be an explanatory sentence, built as a scenario, combined with other visual representations, gain a descriptive feature with analogies and metaphors, be a binding factor between the past and the future, be an environment where emotions and feelings are conveyed, allow the design to be solved from various perspectives by narrating it as shown in examples (**Figure 4.19**). However, experiencing and being experienced, which is one of the primary features of architectural design, is incorporated to the design process with narrations. Imagination, on the other hand, joins with these experiences to form a creative layer in the design process. If the designer considers the design as a series of experiences and perceives the spaces as lived experiences in the mind of the designer, the expression of this emerges as an expression within the scope of verbal representation. The possibilities of narrations within the framework of the symbiotic relationship established with imagination are illustrated with examples as situations in which creativity emerges in the architectural design process. Examples show that it is processed as flow in planning the space, assigning the atmosphere to the space, and designing circulation and programs.

The aim here, by exemplifying all these verbal representation media, is to emphasize how imagination can be represented with verbal expressions when considered together with different actions, inputs, and media in the design process. In this context, it is understood that the creativity of imagination in design representation is not only verbally established but also visually due to the nature of the architectural design approach. Imagination and creativity are possible with the multi-use scheme established between verbal representations, and it becomes clear with the inclusion of visual representation media in architectural design. When these nonlinear processes

and multi-usage representation media are examined, it can be said that they construct a pattern according to their usage intensities. Apart from the common patterns formed due to the nature of the design process, the frequency of use of verbal representation varies from individual to individual. These representations that emerge as a result of design actions, on the other hand, allow for the tracking of imagination. At this point, the potentials provided by verbal representation can be discussed in the context of its enrichment of visual representation and its relationship with mental representation. The existence of verbal and visual representation allows the design process to gain a complex structure rather than linearity, and the meanings realized in the relationship between these two carry clues about imagination.

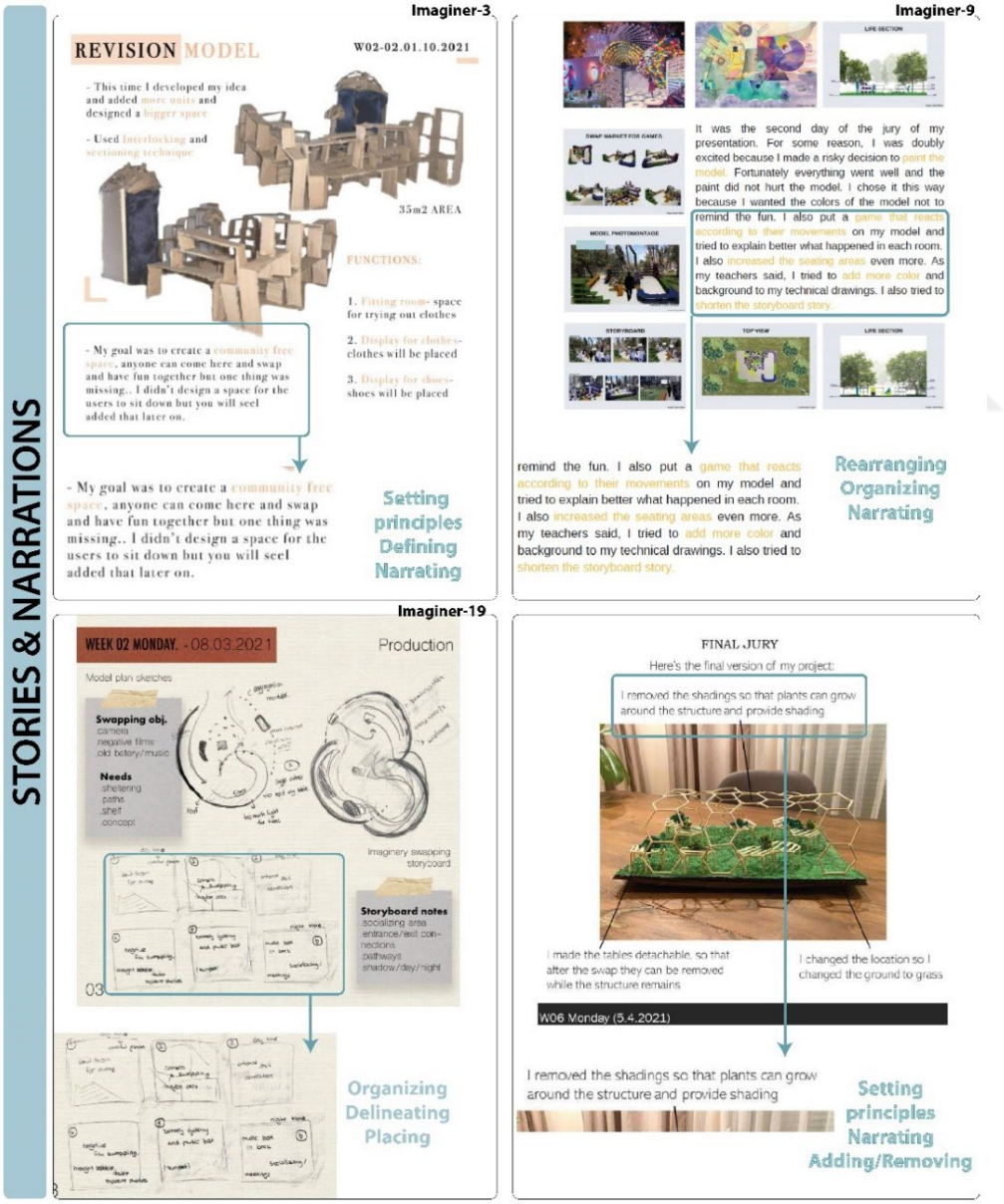

Figure 4.19 : Examples of story/narration usages in design diaries.

4.2.2 Visual representation

Visual representation has an important role in external representation due to the direct relationship between architectural design process and visual perception which has been explained in the previous chapter with its different aspects. Accordingly, visual content analysis of design diaries was made within the framework of the different potentials of the practice of drawing and producing in hand-eye-brain coordination. Although different visual representation media can be examined, the research is limited to these 9 representations based on data drawn from design diaries. These visual representation tools are determined as diagrams, plan drawings, section drawings, perspectives, storyboards, collages, videos/films, physical models, and digital models, and they are examined thru examples taken from design diaries.

As explained in the external representation section, diagrams occupy a large space in the design process and are used for various functions. When sketching and drawing practice is gained, thinking with diagrams is one of the important factors that guide the design process. This situation can also be seen with the frequency of diagrams concentrated in the second project as it became to a habit to design with diagrams (Figure 4.20).

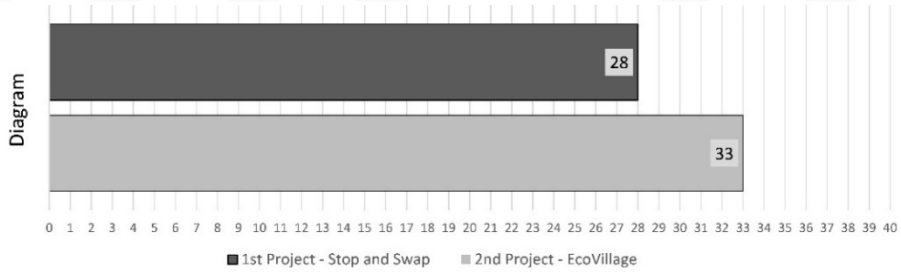

Figure 4.20 : Graph of diagram usage intensity in design diaries.

Considering the relationship of diagram usage with imagination, the fact that diagrams transform into design actions within the multi-use scheme ensures that it is a representation medium that has no definite scope and limit and thus makes creativity unlimited. When the examples taken from the design diaries are examined, it is seen that the use of diagram is related to different design actions. Although their characteristics vary according to the drawing and sketching habits of the designer, some of them created diagrams only with words, while others guided the design process with diagrams. Diagrams, as demonstrated by the examples, can specify a circulation in the form of a plan scheme, describe a flow, provide information about

the construction stages, include exercises for the form, provide mathematical and geometrical arrangements, and carry various information from all design stages. This situation shows that all 4 functions of imagination can be examined in different diagram usages (**Figure 4.21**).

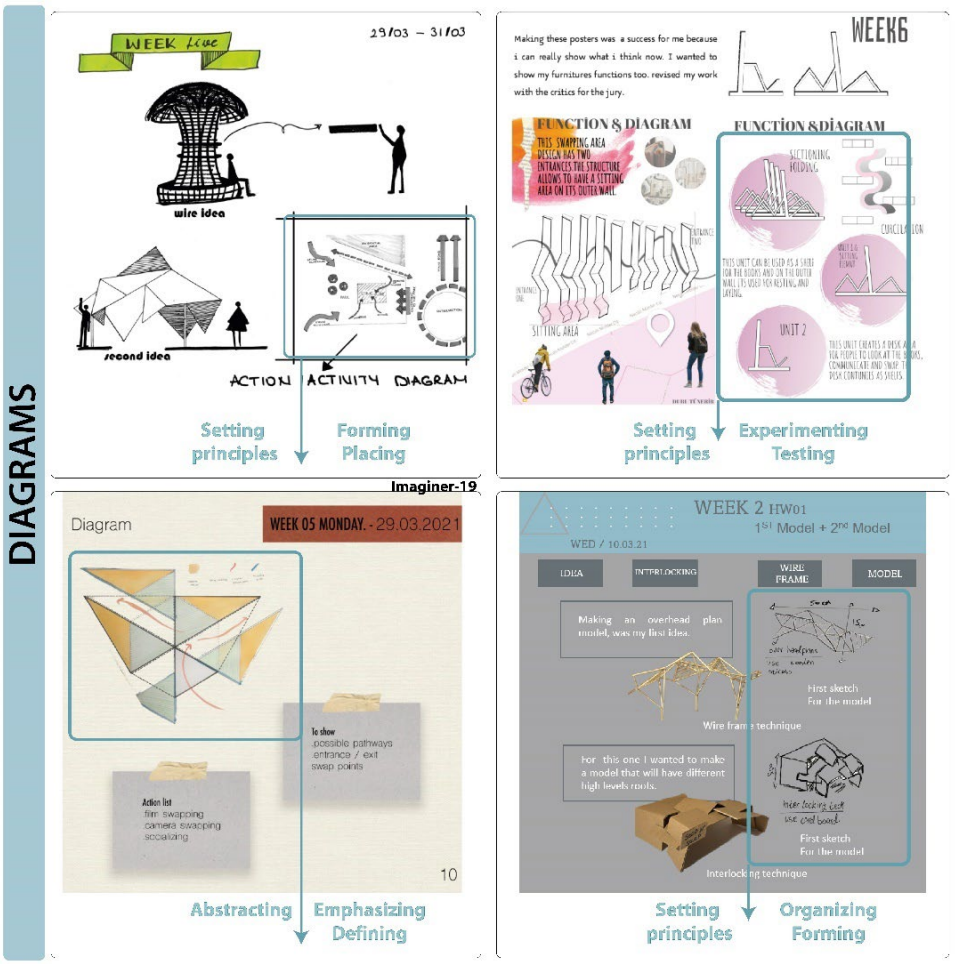

Figure 4.21 : Examples of diagram usages in design diaries.

Plan drawings, which are included in the diagrams, are one of the key representation media that guide the design process.The fact that the plan in the design diaries increased from the first project to the second project (Figure 4.22) shows how necessary the plan drawing is in solving complex spatial problems.

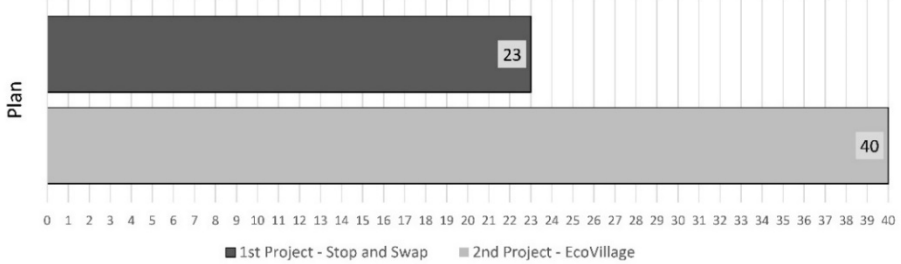

Figure 4.22 : Graph of plan drawing usage intensity in design diaries.

When the plan plane is considered as a representation medium where ideas are transferred to a two-dimensional environment during the design process, it also defines how the person organizes the spaces she/he designs and how she/he establishes relations between the spaces. It is seen that architectural drawing techniques are used in most of the design processes. When we look at the examples of plan drawing, it is understood that students draw plans for different purposes at different design stages (**Figure 4.23**).

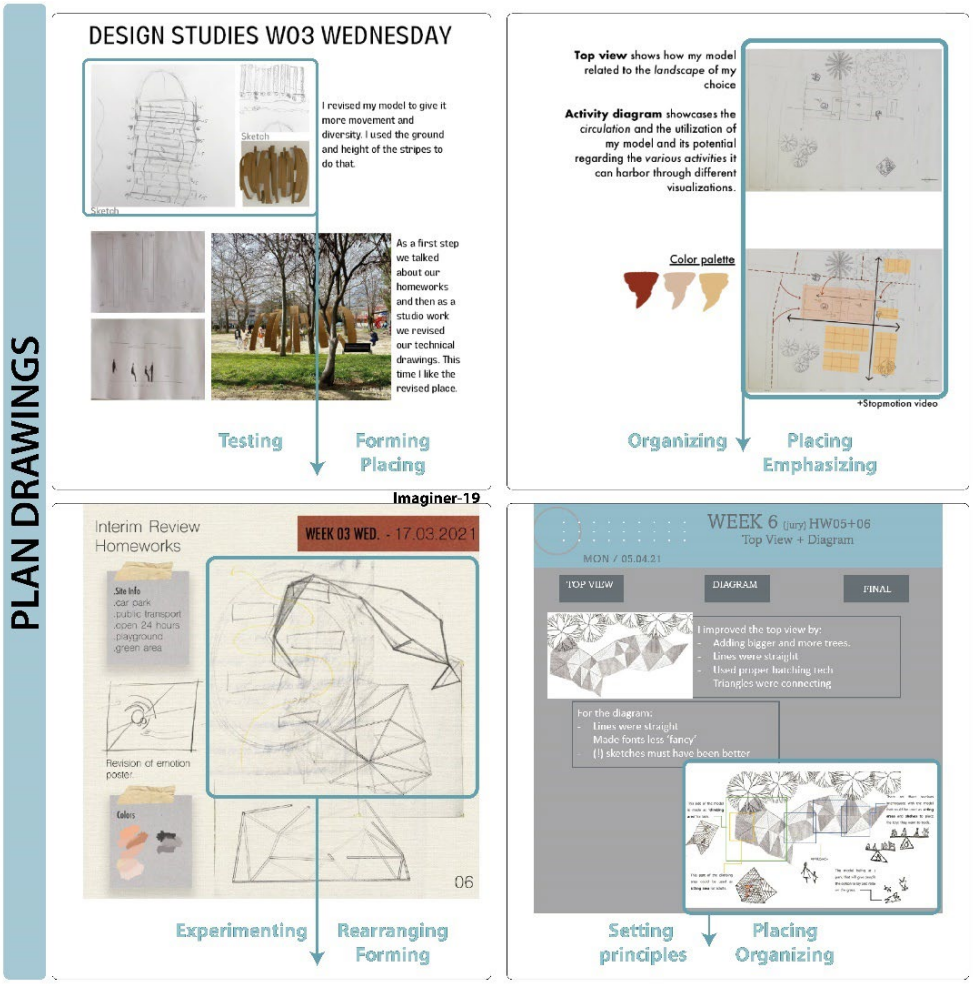

Figure 4.23 : Examples of plan drawing usages in design diaries.

At the point where the design begins to be grasped spatially, students make design decisions, organize, place and rearrange, and use the plan drawing. However, as a common approach, students recursively sketch the plan drawings while developing their designs. This situation makes us think that the plan drawing is an important factor in the student's three-dimensional perception. Imagination, on the other hand, is involved in the process by drawing the plan through transformative and iterative functions. In this context, the fact that design is represented in the plan drawing shows

that it has a decisive role in organizing the design or making certain decisions. As in other representation media, the design approach is tracked by searching for the meaning of drawings through colors, highlights, lines, indicators and shapes. The relationship between designer's decisions and plan drawings, which can be interpreted as a design method spread throughout the design process, contains clues to imagination. This situation can be discussed in design diaries through the students' storytelling of the plan while making a design decision, experimenting with formulas and dashed lines, using them as diagrams, or drawing layout diagrams based on the model photographs they took.

The section drawing; has different potentials in design representation. Apart from abstract and concrete information it embodies, it also shows the verticality of space, unlike the plan. In design diaries, average number of the students were using section drawing, which were distributed throughout the design process in both projects, regardless of the complexity of the problem (Figure 4.24). Because it takes place in external representation as an experimental and perceptual medium rather than organizing or schematizing the actions used in problem-solving.

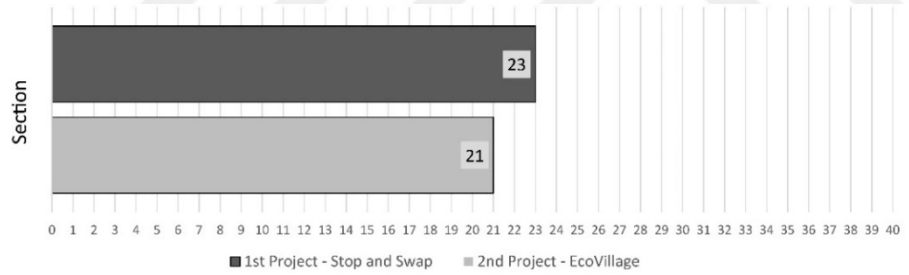

Figure 4.24 : Graph of section drawing usage intensity in design diaries.

As it can be understood from the examples in the design diaries, the section drawing does not offer an experimental approach like the plan drawing in the design process. However, although it is drawn on a two-dimensional plane like a plan drawing, it is seen that it is mostly used to establish a narrative and to add experience to the three-dimensional space. The addition of human figures, lines, flow, materials, and details to section drawings transforms the representation from a technical drawing into multiple narratives that are used in conjunction with other representations. In this case, imagination can be observed as scattered throughout the design process. However, the fact that it is not used as intensely as the plan drawing causes imagination function, which can be associated with the section drawing, not to spread to the space in the

verticality in the context of creativity. The tracking of this creative thinking process is determined according to the purpose for which the section drawings are used. For example, it appears as different functions in establishing an organization, representing a narrative, or establishing/revising the atmosphere and spatial relations (**Figure 4.25**).

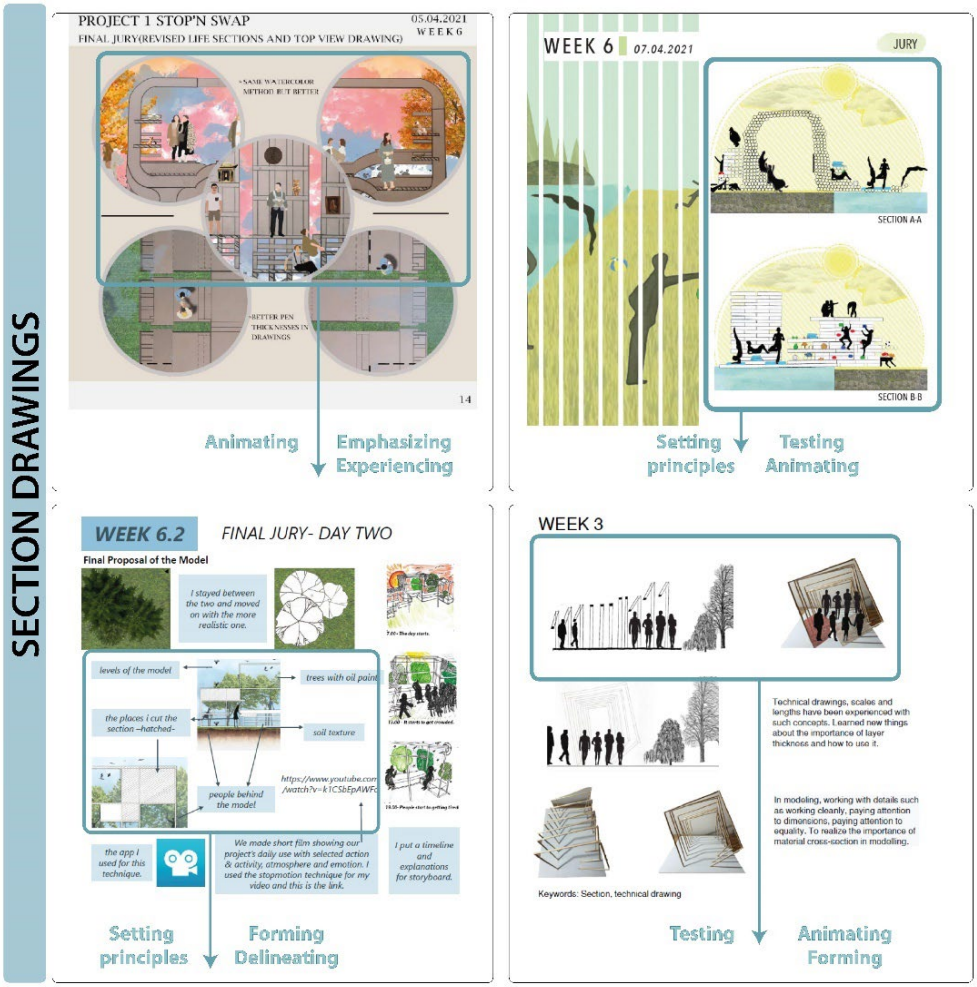

Figure 4.25 : Examples of section drawing usages in design diaries.

Perspective drawings, which also serve as a form of communication, provide clues to the entire space, together with other representation media. In this way, in the case where the design is established with this representation medium, the design goes beyond being a problem-solving process and turns into a dialogue in which the designer internalizes design and the visual in his mind is transferred physically. This shows that the use of the perspective drawing medium increases when the problem becomes more complex. As can be seen from the design diaries, as the design problem became more complex after the transition from the first project to the second project, students needed to draw perspective in order to perceive their designs (Figure 4.26).

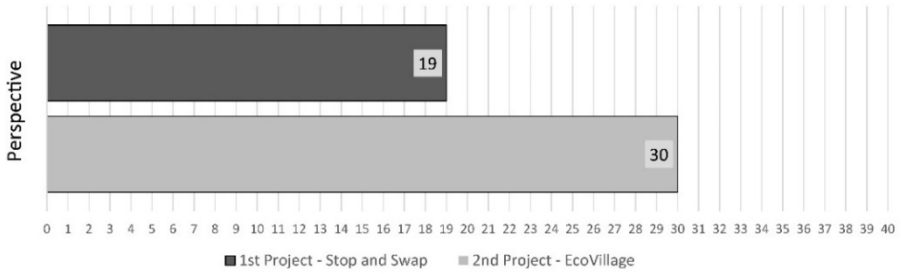

Figure 4.26 : Graph of perspective drawing usage intensity in design diaries.

The design's three-dimensional potential, which gains new potentials with each line drawn in the process of making design decisions, is tested in terms of how it generates a perception in the human eye. The use of perspective, where the relationship between interior and exterior, material and details increase, provides an environment for the designer to test and perceive design as can be seen in the examples (**Figure 4.27**).

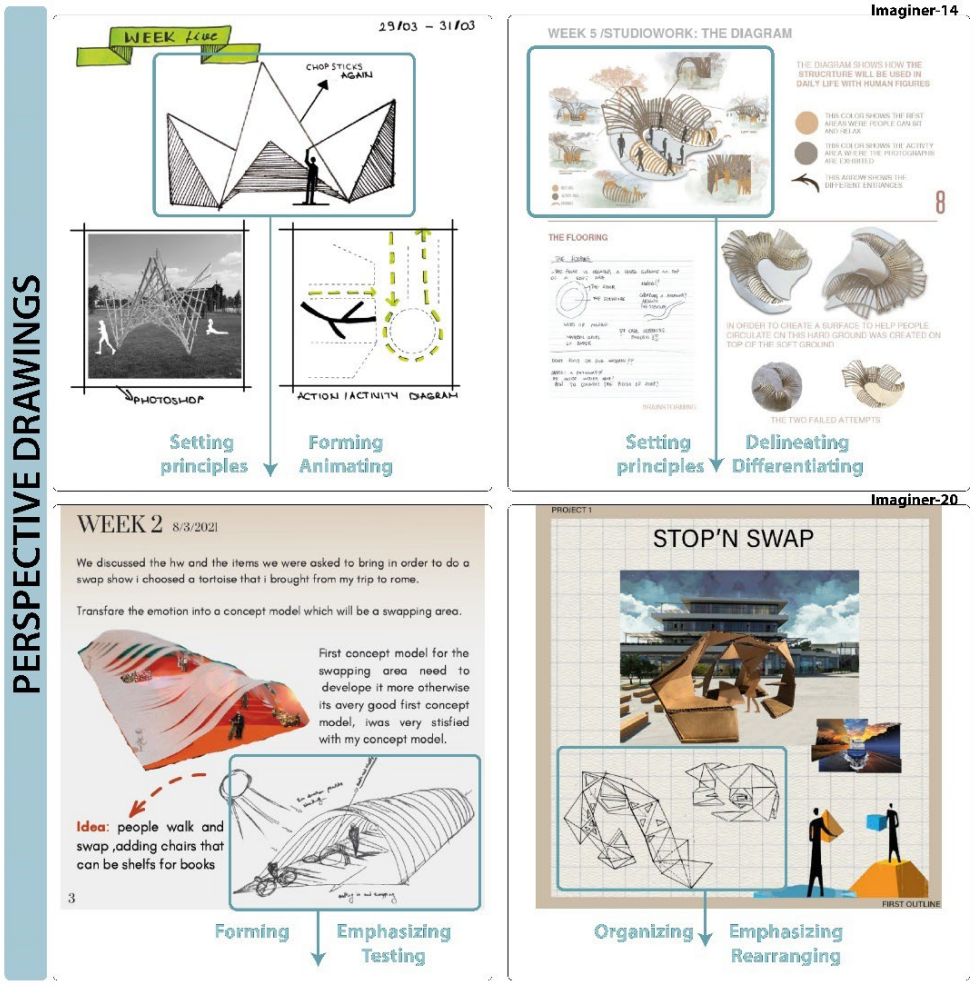

Figure 4.27 : Examples of perspective drawing usages in design diaries.

Considering that creative thinking manifests itself with the existence of experience along with perceptions, here imagination is dominant in perspective drawings. With

this representation and imagination functions, the designer can visualize experiences by calling information from memory, organize them as diagrams, and produce alternatives by changing perspective according to the context As can be seen from the examples, perspective drawing is used to emphasize, describe, animate design decisions and to conduct experiments and tests with an experimental approach. This situation directly reveals the relationship established with imagination functions. The existence of experiential, transformative and iterative functions can be observed according to the repetition, detail and narrative of the perspective drawing.

Storyboards, that is, transferring the designed space as frames within a series of events, also include the perspective medium. However, the important point here is that the user factor and time factor are included in the design. In this context, storyboards have an important place in the inclusion of daily life in the design and the realization of the idea in the mind. The decrease in the number of storyboard usage (Figure 4.28) shows that the second project is not narrative-oriented, but on the contrary, considering the increase in the plan drawings, the expectation for a complex spatial solution has arisen. This finding can be criticized as the storyboards are not handled in sufficient detail.

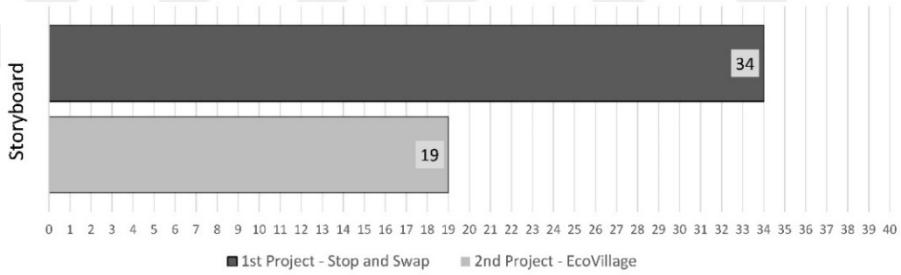

Figure 4.28 : Graph of storyboard usage intensity in design diaries.

Due to the potentials it carries, its three-dimensional thinking practice, its ability to handle space in a flow, and its multi-layered state, it has led to experimentation and creative spatiality in the first project. Although design students think about spaces in a process and put them into a flow, they represent it in narratives, not as a storyboard. Storyboards, which are related to the experiential function of imagination, include creativity in the design and ensure the establishment of time-user dialogue. The point that draws attention in the examples is that the storyboards are handled repetitively and that the design thinking is tried and tested through the storyboards. In this case, iterative function of imagination is included in the design with different details of spaces and different moments of time. If the designed space is conceived as a flow and

also as a testing mechanism, the physical equivalent of this appears as a storyboard, and the designer places her/himself in the storyboards the designer has constructed (**Figure 4.29**).

Figure 4.29 : Examples of storyboard usages in design diaries.

Apart from drawings and sketches, the use of visual expression in external representation seems possible with collages as well. Collages, used both in analog and digital format, provide a multi-layered structure in the creation of the concept, in the early phase of design, causing potentials of design to be multiplied. In the second project, it is seen that there is a significant decrease in the use of collage (Figure 4.30). This is since in the first project, students were asked to explain their concepts with a collage while creating them. However, the important point here is the presence of students who show their concepts, narratives, or the atmosphere they want to create with collage, even if it is not desired in the second project. In addition, the use of collages as analog requires a certain amount of practice, and they are not familiar with

software to make them digitally, and they are still first class, making these findings debatable.

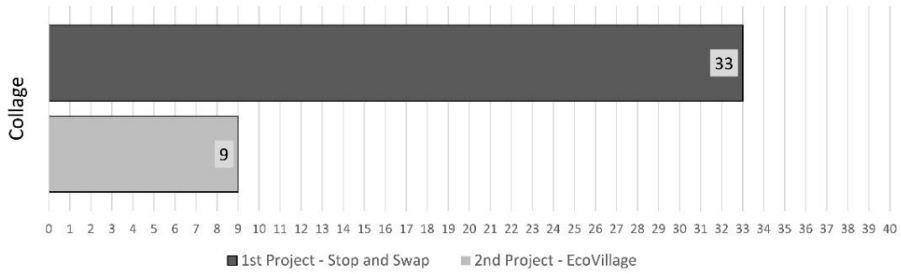

Figure 4.30 : Graph of collage usage intensity in design diaries.

Collages, which can have different meanings from each other, change their layers according to the technique used as can be seen in the examples. For example, some of them created their collages with their designed models, some of them used abstract visuals etc. to sense the atmosphere of their idea (**Figure 4.31**).

Figure 4.31 : Examples of collage usages in design diaries.

In this case, collages handled in the design process appear as a tool employed within external representation. While being a tool supports intuition in approaching the design problem, it also supports the relationship between abstract and concrete design ideas. The collages requested in the first project provide a transition from abstract to concrete during the conceptual design phase. It can be observed that the students who use collages exercise their creativity as they make decisions about their designs and engage with physicality in the collage-making process while creating an abstract-concrete relationship. In this case, imagination is conveyed at a similar rate and is included in the layers in the collages by being associated with design actions.

Video and movies, which can be considered a medium where the features of storyboards and collages come together, are also considered one of the representation media that create creativity in the design process. It shares characteristics with collages and maintains creativity in its layers because this representational medium offers meaningful integrity when combined with other representations. It has a similar character to storyboards as it defines a process and flow. Although its usage in the design process appears to be limited (Figure 4.32), it is regarded as an important medium for the perception of a cinematographic spatial narrative.

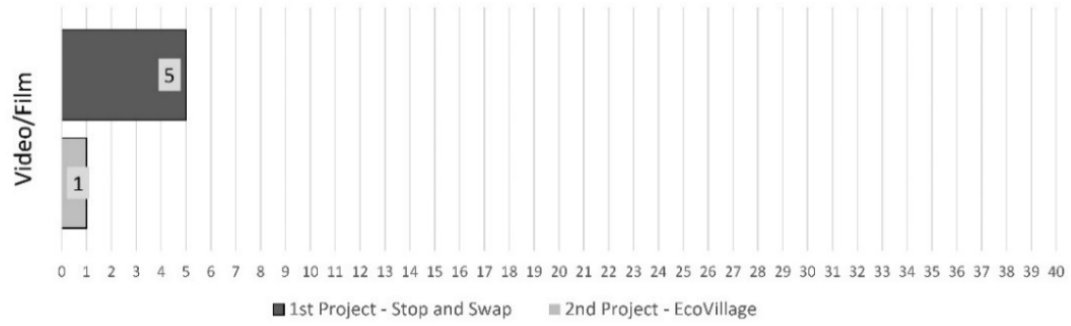

Figure 4.32 : Graph of video/film usage intensity in design diaries.

This production technique, which consists of sequences where storyboard and collage come together, has features that improve design with the help of imagination. These sequences that make up the videos can be elements depending on the experience, as well as the cinematographic representation of the metaphors that indicate the concept of the design idea. It is even possible to think of the inclusion of photography and cinema in the architectural design process itself as the result of associative function of imagination. In this case, while videos and films offer a special environment beyond

other narrative media, the phenomenon of time as perceived by the designer is included in the process. The scope and limits of imagination established by video production, as understood from the examples in the design diaries, serve as an indicator in the creation of the space narrative and the perception of the conceptual design.

Physical models, which are used extensively especially in first grade, provide an experimental approach to design practice, produce alternatives, and broaden the perspective. The acquisition of this practice can be followed in the design process as a response to the bodily transfer of thoughts. Although the decrease in the usage intensities (Figure 4.33) does not point out to a significant difference, it is possible to understand how the use of physical models is decisive in design. In this context, physical models transform simultaneously with the intellectual world of the designer together with the actions they carry.

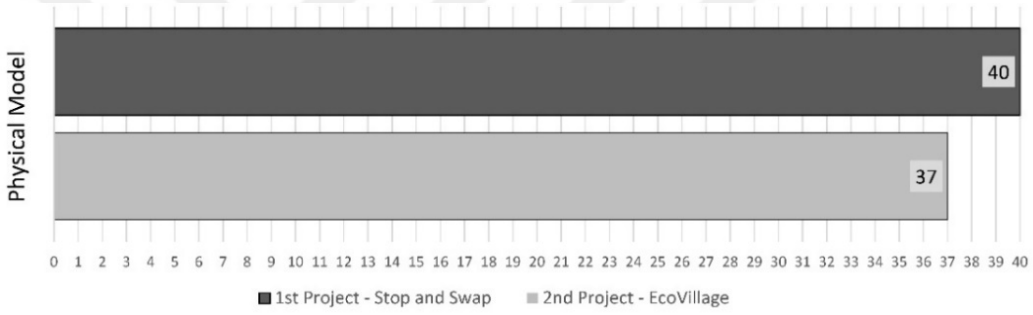

Figure 4.33 : Graph of physical model usage intensity in design diaries.

Exploratory models are dominant in design education rather than the finished product, and in this case, modeling is considered important both in the creation of alternatives and in the application of the trial-and-error method. Moreover, the construction stages of the models gain importance, and it can be discussed how it provides an attitude in complex design decisions. Imagination also places itself in actions within this representation medium, and it can be observed effectively in the forefront of experimentation, the production of the new and the change of design as seen in the examples taken from design diaries. Students use physical models to experiment, make design decisions, test them, animate them, and most importantly, perceive them. According to the design diaries, including examples seen in the design through model trials is also identified as a common technique seen in first graders, demonstrating that imagination uses the combining feature in this context (**Figure 4.34**).

Figure 4.34 : Examples of physical model usages in design diaries.

Digital models, which are examined in comparison with physical models, have different potentials in the design process. Digital representation media, which are quickly involved in the processes of designers with their practicality, fast results, and retrospective work, seem to be useful for post-production as well. While the use of analog representations is more common in first grade, digital representations have also been taught as of the second project in the period under review. In the design diaries, this transition is evident from the fact that the digital model was not used in the first project and almost everyone started using it in the second project (Figure 4.35). In this context, various modeling programs have been included in the design process. At this point, it has been determined that digital modeling is used as a representation media which design ideas are tested practically in the design process. In the design process, improvements and design decisions in details that cannot be made with the materials used in the physical model are possible with digital models. At the same time, it is seen that it is used predominantly in the spatial production process because it provides

different perspectives in planning the design, monitoring the section and plan. However, it is clear that first graders do not create exploratory models using digital tools. In this context, imagination is included in digital modeling on the actions where the design is developed, transformed, and changed spatially, apart from the conceptual design phase.

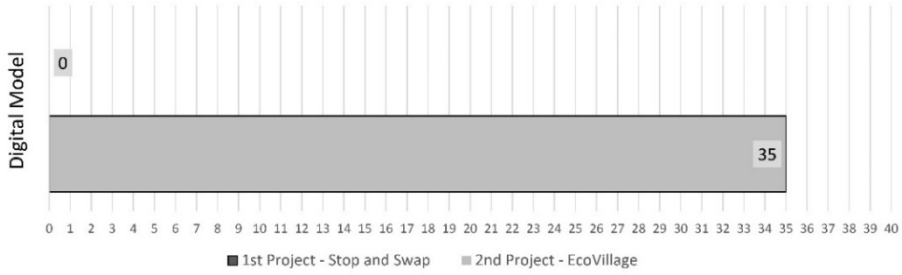

Figure 4.35 : Graph of digital model usage intensity in design diaries.

Representation media that architecture students use within their design approaches were investigated in the first phase of case studies, which was supported by examples, and how they were included in the design in the context of imagination was provided. In this context, the design diaries created by 40 first-year architecture students over the course of a semester were examined. The representation media used in this analysis were separated and categorized, and imagination was revealed by establishing a link between the meanings they carry and the design actions they performed. However, examining only the design diaries is not considered sufficient within the scope of the thesis because they do not reveal all of the students' processes and they produce the design diaries as homework. To understand the process, design thoughts and design actions are more important than the activities they do in the course. However, by following these actions and representation media with the design diaries, it is possible to understand which function of imagination is emphasized, and it has been seen as a determining factor in the formation of case studies questions.

4.3 Case Studies Phase II: Interviews to Reveal Imagination Mappings

The thesis seeks to investigate the four functions of imagination by following them through representation tools and design actions. As a result of searching the design actions as keywords in the in-depth interviews, the design processes of the students were revealed and examined. The tools, actions, concepts they focus on, and the design process in their combination will be traced with the identified four imagination

functions. Within the context of case studies, the data obtained from interviews was converted into graphics named as imagination mappings, and the students' use of their imagination in the design process was observed (Appendix-A). The similarities and differences established by the students' imagination in the design processes gained importance in this case and were examined in the context of the thesis's questions. Within the scope of the thesis, the data obtained were handled as common patterns and common behavior groups established with imagination functions, and the thesis question concerning the role of imagination in the design process was answered. At this stage of the study, the data obtained as a result of the interviews with the students and imagination mappings created will be discussed in detail to understand the scope of imagination in design thinking.

4.3.1 Common patterns of imagination

Considering the distribution of the students interviewed within the scope of the thesis according to their demographic information, it is determined that they are between the ages of 18-23 and they reside in Istanbul. Five of the 22 students are foreigners and all of them are graduates of Anatolian high schools or equivalent high schools. Considering that students from different geographies may have different approaches to design, and therefore they receive undergraduate education from different backgrounds, it is thought that this situation diversifies the case studies of the thesis study.

Looking at their hobbies, it is possible to say that there is a similar diversity. The fact that most students draw and travel as a hobby is considered as crucial data that supports the various functions of imagination, together with the representation tools they employ, their level of experience, and their understanding of space in their memories. Doing sports, reading books, watching movies, taking photos, and listening to music were other hobbies mentioned in the answers of the students. With these answers, it is understood that students tend to develop themselves socially and this improves their design processes. In addition to hobbies, most of the students were involved in university student clubs. However, due to the coronavirus pandemic, first-year students stated that they could not be active both professionally and socially through clubs. Some of the students interviewed claimed that they participated in numerous workshops and internships, while others stated that they occasionally worked in

graphic design, text writing, and industrial design. This shows that almost all of the students are interested in design in extracurricular activities in various ways. However, the fact that the majority of them have no work experience is regarded as significant data in the context of the development of architectural practices.

The answers given to the question about the reasons for choosing to study architecture, which is one of the survey questions asked to understand the approaches to architecture and architectural education, focus on the concept of creativity. It is understood that students evaluate creativity as the ability to design with a spatial approach. These discourses, which provide data on their expectations from architectural education, indicate that students seek creativity in their design processes. Their desire to produce something and their experiences in this regard were expressed as the main reason for most students to choose architecture. It is thought that imagination of the students who have included the practice of producing and designing in their daily lives also develops in this context. Another striking reason is that architecture is not perceived as a numerical, verbal, fully theoretical or fully practical department, therefore it is evaluated as a mixed structure. Architecture and architectural education, which is thought to enable interdisciplinary dialogue, also affect students' approaches to design processes. It is thought that the state of being in between or being mixed, which allows them to think multi-dimensionally, enables them to use different functions of imagination at different stages of the design process.

The responses to the question of which courses in architectural education students are most interested in were expressed as design-based project studio courses that include design and creativity. The intensity of the interest in design courses, which form the backbone of architectural education, can be interpreted as concerning the students' desire to work in a versatile way. In fact, within the scope of the thesis, this situation is focused on and the design processes in the project courses are emphasized. Apart from this, the courses of interest are equally distributed as history and digital courses. History courses enrich the design process due to the potential to acquire architectural knowledge, and digital courses are due to the use of representation tools. It was determined that the construction courses attracted the attention of the fourth-grade students. This explains the professionalized and detailed approach to design practices. Another striking point is that when the answers given to the question are examined, the fourth-grade students give more specific answers than the first-grade students and

express their interest by including the design approaches. In this case, it is necessary to consider the process from the beginning to the end of architectural education as a whole and to evaluate the students' approaches as a developing phenomenon in this context.

Similarly, answers to the daily time spent on the project in the studio also provide data on the approaches of the first and fourth graders to the design processes. First graders stated that they worked an average of 7 hours a day, and fourth graders stated that they worked an average of 10 hours a day for the project course. The increase in time given could be attributed to a decrease in course intensities, as well as evidence that design practice is becoming more prevalent in architectural education through the end of it. The answers to this question show that all of the students who participated in the interview put a lot of effort into the project studio courses and included the design processes outside of the classroom in their daily lives, so the design actions spread to this process.

When the interviews with the students are analyzed and their mappings are interpreted as explained in the methodology, it is possible to observe common approaches towards the design processes and the functions of imagination they use accordingly. Although each student has unique stages, representation tools and design methods, situations established as common patterns are revealed with functions of imagination. The different functions of imagination, the ways they come together in the process, the relations with the design actions used, and the representation media have common patterns in triggering these actions. If the common approaches are listed as a result of the findings.

- Iterative imagination is the function that each student heavily incorporates into their design process.
- Creating alternatives, experimenting, and determining new rules in the design processes ensure the concentration of iterative function of imagination.
- Associative function of imagination has been observed as a secondary imagination function, but there are rare variations.
- The keywords used in determining the concept and their direction of design intensifies the use of associative function of imagination.

- Towards the end of the design processes, transformative function of imagination gains effectiveness.
- Apart from the representation media, the act of thinking increases the intensity of the productions carried out in the mind.
- The existence of the act of thinking shows that imagination also spreads to the process effectively.
- Although the representation tools used do not establish a definite common pattern, certain tools match certain actions and in this case, these tools can be related to imagination.

In this part of the thesis, it is aimed to evaluate the involvement of imagination in design processes as common patterns. At this point, each imagination function will be examined separately in order to identify common patterns. After analyzing the relationship between the common approaches in the design processes and imagination, the representation tools, and the state of their actions in the design process will be evaluated within the framework of imagination. In this context, the design processes of 22 students interviewed will be examined under the name of imagination functions and the common approaches that are itemized with the findings will be explained in detail.

When the graphs containing imagination function ratios created as a result of the interviews are examined, it is seen that each student participating in the interview uses their iterative function of imagination at the primary or secondary level. It has been determined that while fourth-grade students use iterative function of imagination at the secondary level, first-grade students mostly use it at the first level. Considering that iterative function of imagination is included in the design process in terms of making production, producing alternatives, and increasing production by establishing abstract relationships, the emergence of commonality in first-grade architectural education is considered to be predictable. The fact that architectural practice is focused on making and producing directly addresses the iterative function of imagination. In this context, it is aimed to give first-year students the habit of producing and working with alternatives. However, the fact that iterative function of imagination effectively affects the design processes of the students in the fourth grade shows that the students somehow gain this practice. Without claiming that imagination is only related to the

act of doing in the physical environment, the designs that students produce in their thoughts and test in their minds as exercises show the effectiveness of iterative function of imagination.

The fact that iterative function of imagination is used intensively by each student without exception can also be seen from the words in the created word clouds. Students frequently used the words “make, try, form, create, think, different” in the interviews. Iterative function of imagination, which is associated with the act of doing and thinking, includes design processes such as designing by experiment, producing alternatives, creating forms, producing by thinking, searching for change, abstract thinking and determining rules. Considering the interviews with first-year students, the common approaches developed within the framework of iterative function of imagination overlap with the expectations of the studio. The resulting words are matched with the assignments requested during the design process of architectural studio, and it aims to produce alternatives by experimenting with models and drawings. In the fourth grade, this situation gains a clearer definition and the situation of producing with alternatives is detailed. These students, on the other hand, immerse themselves in the practice of making their design decisions. However, when the interviews were examined, it was determined that the practice of working by producing alternatives continued in the mind during the thinking process. This situation was expressed by the students as the visualization of images of different designs and forms in their minds at the beginning of the project. Although the elimination of alternatives is provided by different techniques for each student, the importance of physical production is emphasized. In this case, students have built their iterative function of imagination with the diversity of designing and making.

Students of both grades examine iterative function of imagination in their relations with abstract concepts. This situation draws attention as a joint process with associative function of imagination. It is seen that they perceive the transition from abstract to concrete as a transition from abstract concept to physical space while producing a concept. To establish this relationship, first-year students were expected to make design decisions based on emotions in the definition of the project. Imagination mapping of students who progress without completing or internalizing this stage is also directed to other functions out of context. However, the fourth-grade students' approaches to abstract concepts ensure that a design decision is made during

the conceptual design phase. First-year students stated that they had difficulties describing the abstract production process. However, fourth-grade students stated that they advanced this situation intuitively. When the interviews were examined, it was seen that the process of transforming abstract concepts into physical space was settled fluidly at the conceptual stage. In this case, it can be said that abstract thinking is taught to students as a practice throughout architectural education.

When the graphs of the design processes are examined through imagination functions, it is seen that iterative function of imagination spreads from the beginning to the end of the process. This common approach is related to the tools and actions used in the design process. Both grade's students make decisions about form both in their thoughts and in the designs that they produce in the physical environment. While these decisions are handled concerning the concept at the beginning, they turn into design decisions for the details of the space or the building in the later stages. In any case, these processes, which are based on creating and producing, are associated with almost all design tools. However, when examined in more detail, the iterative function of imagination in the generation of alternatives is compatible with physical and digital models and various drawing media. The order or intensity of their use varies depending on the stages and predispositions of the students. As an example, from first-year students, the student began her design by looking for abstract relationships with various keywords and uncovered definitions of keywords to make concrete design decisions. Due to the dominance of the approach to the abstract word, she made various attempts on the model. These trials were repeated in every problem encountered during the process. These repetitions expressed in the interview were conveyed in the form of thinking by experimenting with a model and designing by thinking. This transformation can be exemplified similarly in the fourth graders. The student stated that she started the process with the thought of "I will make a different design", and for this, she made various design decisions in his approach to the field. The student produced alternatives in the section drawings by preserving the design decisions she made. These section drawings, which form the basis of the project, have been detailed concerning other representation tools throughout the process. In this case, although it may seem like different approaches, the use of iterative function of imagination in design processes is associated with actions such as setting principles, abstracting, differentiating, forming and experimenting. It has been determined that the approaches

have diversified due to the spread of these actions in the design process. However, predominantly, it was found that iterative function of imagination was associated with the potential to produce tools that would represent the existence of students' design ideas. Therefore, the existence of iterative function of imagination as a common pattern is also important in architectural education.

When imagination mappings of students were examined, it was determined that the most used function proportionally after iterative function of imagination was associative. Again, it is possible to make separate evaluations between fourth and first graders. This differentiation contains important data about architectural education. The inclusion of iterative function of imagination in the design processes at the secondary level of all the students interviewed from the fourth graders is discussed within the subject of architecture education. Thus, it seems that these students' primary imagination matches with associative function. However, with the opposite approach, it is understood that first graders primarily use iterative function of imagination, and secondarily, even tertiary in some cases, associative function of imagination. At that rate, the scope of associative function of imagination can be reconsidered. Associative function of imagination aims to create a concept, bring together ideas and information, compare and make choices in the design process. Associative function of imagination, which is searched with the keywords “connecting, organizing, emphasizing, comparing choosing, and setting principles”, focuses on the ability of students to bring their imagination together. When evaluated in this context, the primary use of associative function of imagination in fourth-grade students shows that their approach to design developed and intensified during the conceptual design stages. However, the education that first-year students receive to develop basic design approaches is considered as data supporting that they have not yet gained sufficient practice in establishing context. In this comparison, it appears possible that considering it throughout architectural education supports the structure of imagination, which allows information to come together in different ways. However, this practice of first-year students can also be sought in the relationship they establish between their daily lives and design processes. In this case, associative function of imagination is involved in the design process from different scales and knowledge levels and plays an active role in the minds of the students.

Associative function of imagination, which progresses together with iterative function of imagination as a common approach, can also be read from word clouds created by students' expression of design processes. At this point, the obvious approach is that associative function of imagination is built over words compared to other functions. When word clouds are examined, it is clear that the words related with associative function of imagination are keywords associated with the concept. These concepts include form design decisions as well as data obtained from analysis during the design process. However, the common approach seen by the students of both grades is that the keywords emphasized by relation with associative function of imagination are for concepts that bear traces of their own lives. This situation can be provided with acquired information from examples, as well as the information of a place experienced in daily life. This situation shows that students' abilities to experience, perceive and synthesize in order to reuse the information they have acquired have developed. For example, when the word cloud of a first-year student who included associative function of imagination in his design is examined, it is understood that the concepts of "tunnel" and "music" are related with the design idea. During the interview, the student stated that he started with music, which is his field of interest, and then he associated the meaning of music for him with the shape of a tunnel. At this point, the concept of analogy and metaphor aroused the student's associative function of imagination. Imagination has been a trigger for the student to bring together different knowledge and spatialize it. When the student finds himself creative, he said that it is the part where the concept is created consciously. The differentiation of the whole idea and concept behind the design rather than the shapes and forms shows that the student builds his creativity thanks to associative function of imagination. Although this is not accurate for all first-year students, it is understood that during the early stages of the design, it was a studio setup aimed at activating associative function of imagination. Because it is thought that this situation has been intensely focused on in the future, within the framework of the relationship between architectural design and context. It is assumed that the role of the education they receive is one of the reasons why associative function of imagination dominates in fourth-grade students. It has been determined that in these students who have received a graduation project, the approach of reconciling examples with their projects predominates. In this case, examples become a trigger for associative function of imagination and expand students' perceptions. The ability to compare and make choices in setting design decisions that

they can use in their projects is considered one of the obvious effects of associative function of imagination.

When the design processes are examined, it is clear that all of the students contributed to the process with their associative function of imagination. Their process, which began with conceptual design, intersects with the concept at every point where they make a design decision and is visible even in changes made as they approach the final. This situation is related with the versatile attitude of associative function of imagination. Considering that it is a situation of coming together with different information due to its features, associative function of imagination forms the basis of design thinking even though it takes place in different intensities and approaches in the design processes of students. When the design processes are examined within the framework of the relationship between imagination and representation, it is seen that students involve associative function of imagination with verbal representation tools. Because while students are creating the concept of their design or developing their projects with the concept, they reconstruct their own keyword sets and definitions as a design decision. This situation is also related to the ongoing development of the design in mind. For example, the student who primarily employs associative function of imagination stated that he determined the concept of "triangle" for the form and brought it together with the examples he saw and modified it in his mind until the process was completed. As a common approach, the connection of associative function of imagination with representation is not limited to verbal tools and thought, but it has been determined that there is such a concentration as a result of the interviews. It is observed that this situation, which can be observed in both grade students, occurs under the influence of the concept created in situations such as organizing, setting principles, and comparing/choosing in the approach to design. The unlimited influence and reaction of the representation tools on imagination enabled the students to create their imagination mapping, but the spread of associative function of imagination as a common approach to the process emphasizes the relational side of design thinking. The progress of the student, who creates the concept through colors, by using colors as a rule in her model works is considered an effect of associative function of imagination. The focus here is that the knowledge associated with colors creates a new spatiality and this is gamified by the student and seen as a creative element. This context and relationship, which can be seen as one of the main goals of architectural

education, is intensified and spread at every stage in the design process, allowing students to develop themselves interactively with associative function of imagination and to produce new knowledge in a spatial context according to each experience.

Although it does not provide a common pattern compared to the primary or secondary use rates established by iterative and associative functions of imagination, transformative function of imagination has an important place in design processes. The common approach established through transformative function of imagination covers the last stage of the design process. The transformative function enables imagination to modify, transform and test the design. At this point, it is assumed that this situation is due to the action taken or the attitude of the transformed design thought toward creating the new. Considering that the design process is progressing through constantly changing and developing ideas, the changes made in the design become more significant when the decisions made begin to materialize and are close to being finalized. Students describe the changes they make in their designs as a usual part of the process. Although the intensity of transformative function of imagination changes in each student, the openness of design thinking to change establishes the continuity of this potential. However, students consider this state of change in their architectural education as a situation that makes their designs creative and offers continuity. In this case, an important finding is that transformative function of imagination includes changes in concept or design decisions rather than just physical and tangible products. Towards the end of the design process, students simultaneously use other imagination functions, make new decisions, and as a result, with the effect of transformative function of imagination, they have the opportunity to both modify the design in their minds and develop their designs by testing.

Transformative function of imagination, which intensifies towards the end of the design processes, interacts more with external representation tools than other imagination functions. In the first grade, physical model is seen as a crucial representation media, and in the fourth grade, the digital model is seen as the representation that triggers transformative function of imagination. Design actions, which can be ordered according to their intensity as testing, changing, rearranging, adding, removing, and adapting, guide students' approaches in the final stages of the design. Fourth-grade students associate this situation with the ability to see the practical effects of changes while working with the digital model. The fact that they

can change and transform their designs quickly and try different things also paves the way for an unlimited transformation process. At this point, students also state that digital tools constitute a potential to test the production capacity of their imagination. Transformative function of imagination ensures that the design product is constantly and actively processed in both physical and mental representation. First-year students described a typical strategy for actively maintaining the relationship between mental and external representation, in which they think and then draw something, perceive it, set it in their minds, and then draw or create something while simultaneously thinking. The same approach is also seen in fourth-grade students, and it is considered an important finding that transformative function of imagination strengthens the interaction between mind and hand. In some cases, even if the changes made are not creative or original, the interaction they trigger also activates other imagination functions and ensures the production of the new. On the other hand, for some students, the design process turns into the most creative phase with the new idea added, even if it is in the last stage. In this case, transformative function of imagination plays a decisive role in the design processes of the interviewed students, especially in the final design stages, and establishes a direct relationship with the representation media. Although a common approach to transformative function of imagination was detected in both graders, it is thought that architectural education should focus on mind-hand-eye coordination to develop this. The fact that students are constantly producing with the enthusiasm for improving their designs also supports this situation. Like the position of other imagination functions in architectural education, transformative function of imagination gains meaning when interacting with different representation tools and ensures the diversification of the design process.

Contrary to other imagination functions, as a result of the analysis of the interviews, the place of the experiential function of imagination in design thought was observed as supportive of the design idea. The existence of experiential function of imagination was observed in some of the students very rarely, and in some of them tertiary in the design processes. This situation, which is a common approach, demonstrates the presence of an imagination function scattered throughout the design process. The act of experiencing the space in mind, which is stated as a priority by most students, witnesses every stage of the design process. This act of experiencing allows for changes in design, the creation of spaces, and the definition of spaces. In this case, the

actions examined and sought are included in the analysis as experimenting, testing, narrating, animating, and delineating. Even if it is rare or dominant, thoughts about space and its perception enable experiential function of imagination to be activated and triggered. The analogies and descriptions that the students determined while describing their projects prove this triggering situation. Because the students stated in the interviews that they tried to perceive the space with its features in their minds as a common approach. When it comes to design thinking throughout the process, this common approach does not have a limit; it is always active, including at the start and end of the design. It can be associated with this state of continuity, where experiential function of imagination is one of the important phenomena that ensure originality in design thinking. The clutter in the process reveals the effort of the mind to experience the design. According to one of the fourth-grade students interviewed, these mental exercises are also directed in architectural education. In the previous periods, the guidance of the teachers in trying to visualize the place in their minds caused the students to think about their designs together with the atmosphere. This situation develops similarly in first-year students. From the beginning to the end of the design process, approaches are tried to be imposed on the experience of the space and the experimental production of the design.

Apart from the words that students use while describing the design processes such as “see, show, try”, adjectives, and atmospheric elements, words indicating vitality also show the existence of experiential function of imagination. Each student actively used their experiential function of imagination as a supporting element to develop and direct their designs during the design process. Visual expressions other than words, among the representation tools, cause the experiential function of imagination to be triggered. Experiential function of imagination has found its place in a wide range of representation media, from storyboard and collage in first grade, to plan, section, and models in fourth-grade students. Analogy/metaphor and stories/narrations, which directly appeal to experiential function of imagination from verbal representation media, have been used by both class students. One of the first-grade students, who especially tended to activate experiential function of imagination, stated that she included collage and stories/narration simultaneously in the design process. She stated that this condition allows her to better sense space and to provide a more practical answer to any spatial challenges that may arise because she can experience it in her

thoughts. The place of experiential function of imagination in architectural education is important because of its direct relationship with the means of representation and its supportive structure that spans the process. It seems inevitable for the interviewed students to experience the places they want to create intuitively in their minds. While some students are aware of this, others employ external representation media to engage in experiential function of imagination. The students' approach offers an environment where experiential function of imagination is internalized as a requirement of architectural education.

There are also common patterns that can be examined under the relationship of representation and imagination, beyond the common approaches formed and determined through functions of imagination. Examining the representation media and design actions reveals that verbal representation tools serve a triggering role in the production of design ideas. In the design process, students use verbal representation tools when starting their designs. These become evident as analogy/metaphors and keywords. This situation has a direct relationship with associative function of imagination. Students stated that their approach to the use of keywords occurred as a reminder, determining the themes to focus on, establishing a cause-effect relationship, and creating the concept. It is understood that students are not aware of their use of analogies and metaphors, and they do not regard it as a design tool, but rather as a design approach. However, it has also been determined that it is an element that supports imagination intensely, especially while developing conceptual design ideas. Therefore, the existence of associative function of imagination is provided by keywords and analogies/metaphors in the creation of the concept. Likewise, verbal representation tools interact with each other by activating the decision-making mechanism of students in the design process. When making design decisions, the students began with verbal representations and then progressed to collaborative use with visual representation media. In this situation, iterative function of imagination develops a broad relationship within the representation media. As mentioned, it is understood that transformative function of imagination offers transitions in external representation media together with thought in hand-eye-mind coordination. Associative function of imagination, on the other hand, is supported by descriptions and visuals that convey information about the atmosphere, feeling and story of the

design. All these commonalities reveal the relationship between imagination functions and representation tools.

In the following stages, the relationship between other imagination functions and design tools presents a more complex and intertwined situation. As a common approach, it is seen that the use of visual representation tools intensifies in the later stages of the design. Both verbal and visual representation media take on different roles and stages in terms of their relations with imagination. However, the point to be noted here is that the repetitive use of representation tools in each student also causes repetition in the functions of imagination. This situation arises from the direct relationship between the representation medium used and the act of representation. The more diverse the representation media used by the student in the design process, the more dynamic the distribution of imagination function in the process. The transition between representation media causes students to engage in different imagination functions. Some students stated that they do this consciously, with expressions such as "when I get stuck while working with a model, I sketch, if there is something that I can't solve in the plan, I try to make it on the model". However, since some students were not aware of this and did not gain this practice, imagination density graphs were also repetitive as a result. Furthermore, the common approach here, whether consciously or not, is when students diversify representation media, imagination they use and trigger diversifies and intensifies, paving the way for new approaches to students' creativity.

It is not possible to limit representation media to only external representation as a result of the data obtained from the interviews with the students. Thinking exercises or brainstorming, as the students say, cause them to discover the limits of their imagination. Students' problem-solving skills are strengthened by revealing all potential ideas and designs and considering all different permutations in their minds as alternatives. While first-grade students express this situation more clearly as "I created design alternatives and future scenarios as a result of brainstorming," fourth-grade students state that they activate it by incorporating it into design processes and design tools. This situation in architectural education can be explained by practicing the act of thinking as a simultaneous flow, rather than being a different and separate act.

While starting the design process, students gather information through various types of research, organize the information to process, associate this information to form the concept, make design decisions while creating the concept, form their first foresight about the form according to the design decisions, create alternatives, test alternatives, and make eliminations, turn to different approaches to develop the design, make changes to the design and test it to finalize. Although this process is open to minor differences and details, it is seen that students go through similar paths as a general and summarized scheme. However, design actions vary with representation media, and their use also differs according to the student's design thinking. Although there does not appear to be a common process scheme for the differentiation seen in imagination mappings and density graphs, the actions taken at the point where the design begins, develops, and ends, as well as imagination functions connected to it, form a common pattern. Looking at word clouds, it is understood that design actions focus on acts of doing, thinking, seeing, and trying. Although these actions do not express a design stage, they summarize the actions that architectural design focuses on. Imagination that starts the design from concept to completion and allows the design to be perceived while finalizing are the main elements that nourish and differentiate the student's creativity in the design process. This situation arises from the fiction of architectural education and practice, which is based on problem-solving, designing, developing the design, and experiencing the solution. In this case, it is deemed critical that architectural education focuses on multiplying and diversifying design activities from the first grade to the end. As a common pattern, design actions, representation media, and stages of the design process are all about imagination. Beyond external representational media and design actions, the influence of schemas on students' mental representations should not be overlooked. Because the intensity of the act of thinking plays a decisive role in this common pattern and directs the design processes of the students. Although the process of forming ideas in the minds of students and design approaches contain common patterns, the existing and detected differences form common behavior groups. In this case, imagination is seen in a position that supports each other with the acts of representation. As a result of the interviews, this situation can be understood from the fact that the stages they consider themselves creative are answered concerning the design actions they use. In this context, students internalize the practice of architectural design throughout their education, and their

imagination mapping establishes itself according to their approaches to the use of representation media.

4.3.2 Common behavior groups in imaginative approaches

Individually examined design processes reveal differences and variations in students' approaches. It is possible to categorize diversity according to functions of imagination. However, the functions of imagination, which are considered secondary rather than primary, become important in the definition of groups, as they reveal the approaches of the students in the design process and undertake nurturing and supporting tasks. Furthermore, the design process charts magnify diversity. With this data it is possible to form common behavior groups based on the use of imagination functions. The groups in this case can be summarized as follows.

- Devoting imagination to concepts: Those who have established their concepts from the beginning of the design process, those who use the concepts to produce the new at every stage of the design
- Combining imagination with others' imagination: Those who produce the new by combining the knowledge they have gained from the examples while deciding and developing their designs
- Seeking the limit of imagination: Those who proceed by trial and error, those who tend to constantly produce new ones by actively developing design proposals from scratch in the design processes
- Multiplying imagination with design decisions: Those who establish rules and causality, those who design by assigning the design decisions as a new rule they take with cause-effect relationship and multidimensional thinking, owing to various inputs and outputs in the design processes
- Focusing imagination on a single design: Those who focus on details, those who take the design processes from the general to the details and advance to the finals to develop and elaborate their new product
- Using imagination as narrative: Those who add experiences, those who develop designs by telling stories and treat them as if they were living there

It should be noted that beyond the aforementioned common approaches, the groups under consideration do not specify a definite boundary. Looking at the design

processes of the students, it is seen that they have traces of different groups, that is, students can be included in more than one group at the same time. However, the point that is being addressed and researched here is how imagination is included and represented in design. As a result of the findings in this case, it is possible to conclude that, in addition to common approaches to the design process, imagination is distributed in a variety of ways. While this distribution describes design approaches, it can also open a discussion on architectural design education. The subject of whether there are design procedures that can be adapted to various approaches is raised at this point, along with the importance of when and how imagination is used in the design process. Imagination is followed through the design processes within the scope of the study and reveals its scope with the inferences made as a result of the analysis. The six groups mentioned in this section will be discussed over the design processes of the interviewed students.

4.3.2.1 Group no.1: devoting imagination to concepts

The students expressed as Group no.1, combines their imagination with notions and advances their design processes by dedicating them to these notions that establish their concepts. This group of students directs the design according to the concepts in their minds or the knowledge they have researched and acquired in order to produce the new. It is seen that this approach intensifies and becomes more evident in 11 of the interviewed students. All these students answered the question asked for the stage they thought they were creative as a process of concept development and incorporating concepts into the design. When the design processes are evaluated, the intensity of the actions for concept development and concept usage scattered across the process becomes apparent. This group will be discussed as a process dedicated to the concepts through students' imaginative approaches, with examples from interviews and designs.

The first example is a fourth-grade Turkish female student (imaginer-16) (**Figure C.16**). While describing the design process, the student first stated that it was a different period from other design processes of her previous education years, because it was her last semester, and therefore she wanted to develop a different approach. She focused this difference on not staying within the boundaries of the given area to be designed. Later, she continued her design with site analysis and as a result of her analysis, she decided that the design should be in a transitional function. At this point,

“transition” emerged as the first concept that determined the path of the design process. Focusing on the concept of transition, the student started to research transitions and analyzed this notion. The student focused on creating a bridge based on transition examples that were compatible with her site and concept. The desire to connect two areas of the site and raise the building was integrated with the concept of a bridge. Design decisions that developed with this unity were reinforced on the cross-section. She stated that the focus of the cross-sectional works that span the entire process is always supported by the concept of bridge.

When the student's imagination mapping is examined, it is seen that verbal representations are decisive. Decisions taken based on the concept of bridge determined both the form and atmosphere of the design. Taking this decision in the early stages of the design allowed the student to gain a clearer focus on the design process. In the studies made with sections, the effects of concepts and keywords can be read together with the design actions used. While activities such as organizing, adapting, and forming are defined with definitions and keywords at the start of the process, the fact that we encounter them as sections in the subsequent stages demonstrates the effect of the determined concept on the form. In this context, the student's imagination mapping shows the effective role of associative function of imagination in the process. It is also possible to examine the data on the characteristics of this group from the student's word cloud. While the density of the words "bridge" and "mass" demonstrates that the concept is functioning toward the form, the density of the word "section" also exemplifies the importance of visual representation throughout developing the form. It can also be read from the words in the word cloud that the student starts to develop different trials, searches for alternatives, tries to find different approaches and builds this over the concept of bridge. At this point, the iterative function of imagination that accompanies associative function of imagination becomes important. The concentration of words like “wanted” and “tried” emerges as actions associated with iterative function of imagination. The student conveyed these actions while working on the section in an effort to bring the concept and form together. The student stated that she enjoys processing space and designing in diagrams and that she always tried to experience and imagine about her design during the design process. While representing the schemata in her mind, her imagination includes both associative, iterative, and experiential functions of imagination. The

subject of producing the "different" when we associate imagination with creativity was made possible for this student by seeing the concept of bridge as a different approach to her design. Although the student's conceptual work appears to be imagery for form, which she believes is original and free and in which the new and different are produced, the student attributes the ability to produce such a unique approach to her imagination.

The second example is one of the first-grade, male students (imaginer-1) (**Figure C.1**). Based on his daily life, the student chose the guitar as the product to be exchanged as per the project setup. Although the guitar was the first concept that shaped the design for the student, the schema in his mind played a role in determining the concept of music. Defining his concept by exemplifying from his daily life shows the importance of his experiences in the development of his conceptual approach. The student developed ideas on the concept of music but dismantled the concept of music and sought a spatial response. He came up with the idea of “echo” based on the requirements of a performance space for music (**Figure 4.36**). This decision came together by constructing its design like a tunnel. Although the tunnel idea seems to be a form-oriented concept, it is a holistic approach that develops together with the concept of music created with the information from his daily life.

Although these successive design decisions of the student are based on concepts, the place of analogy and metaphors as a design tool can be followed intensively at the beginning of the design process. However, it is seen that this situation is not developed only with verbal expressions. The spatial response sought and reconciled has come to a position that can be observed and experienced with the physical model. When we look at the student's imagination mapping, it is seen that analogy and metaphors provide a decisive effect as a design approach, while it is seen that the model and digital model provide an opportunity to experience this idea. The student stated that he always experimented with the physical and digital model, but he always kept the tunnel idea and developed his project within this framework. This intertwining of both the concept for the program and the concept for the form can be followed through the design process. While the experimental representations are stated to be for the atmosphere in the music theme, the student employs his associative function of imagination. The design, which is not only form-oriented but open to experiments and development, comes together with iterative function of imagination. In this case, the

student did not attribute the concept he created to keywords only but presented a visible path throughout the design process. In addition, he made additions thanks to transformative function of imagination in the final stages of the design to reflect the idea of echo. These additions not only included rearrangements but also allowed the design to be tested by experimenting with storyboards. While stating that the tunnel idea inspired him, he also noted that the existence of the concept rather than the form is what makes the real difference. The student's imagination mapping offers close proportions and demonstrates that conceptual work can interact with all functions of imagination. As it is understood from the word cloud, approaching the design as an idea also made experimental work possible. The density of keywords that "tunnel" and "music" are compatible with reveals how form, program, and experience can coexist in the student's design thinking. With the word "people," the student stated that he intends to give people the feeling of being in a tunnel, and similarly, with the word "instruments," he directs both the imagined future life there and the entire program to be designed. In this case, the keywords used by the student for the concept demonstrate how the alternatives on which the student dwells, makes design decisions, and tries during the design process support their imagination.

Figure 4.36 : Imaginer-1's concept on music and related representations.

The third example from this group is a first-year Turkish female student (imaginer-9) (**Figure C.9**). This student followed a more systematic process while combining imagination with concepts. Although this systematicity emerged intuitively, the desire to make a different design directed the process. The student first started by questioning the concept of "curiosity", which is the emotion she chose. The concept of curiosity, which differs from other selected concepts, is also related to the sense of curiosity applied by the student to the design problem. She associated her sense of curiosity with the games she found at home. Before this reconciliation, she had the opportunity to question different concepts. Although the detective theme, which she questioned, can

be associated with the concept of curiosity, it was discovered to be spatially symbolic and was eliminated. The student, who brought this situation to the discussion, reconsidered the concept of curiosity as a gamification of the space she designed. In this way, while spatializing the design process, in which she multiplied conceptual relations, she benefited from form-oriented keywords. The student stated that she worked on color for a long time and produced experiments, aimed at the sense of curiosity, and adapted the colors to her space, which she turned into a game in this context. She embraced her design even more when she discovered that it should be in the shape of a "maze" (**Figure 4.37**). In this case, she has developed her design with a set of concepts.

Figure 4.37 : Imaginer-9's concept on maze and related representations.

Considering the student's design process in terms of imagination mapping, the concepts that she determined and associated became the decision-maker in her design. The student stated that she wanted to create a new experience and tried to feel and experience her design at each stage of the design process. Her work towards this is concentrated on collages and physical models. This situation caused the student to use experiential, associative, and iterative functions of imaginations together. The design process of the student, which is concentrated on associative function of imagination, is related with trying to bring together the concepts she has determined. One of the main components of the student's approach is viewing the design process as an element of curiosity and gamifying it. This situation can also be read from the created word cloud. The keywords "people, colors, game", which are processed together with actions such as "think, made, decide, try", reveal the form and function that develops according to the concept. In this way, the diversification of actions and tools leads to the diversification of the concepts she determines and therefore to the increase of the student's spatial experiments. At this point, iterative function of imagination establishes a simultaneous relationship with imagination. The spread of associative

function of imagination to the process so effectively and actively causes the concept to trigger other imagination functions in a systematized way. The student stated that she constantly questioned her ideas in her mind and said that she tried to spatialize her thoughts according to the concepts she determined. At this point, the impact of the examples she saw was too great to ignore. She stated that the situations in her design where she said "ok, this is over" were only at points where she was compatible with her creativity, and she noted that the process in which she connected the abstract-concrete relationship, that is, the beginning of the project, was what established her creativity. The student not only connects the concepts and situations in the scheme in her mind but also tests this through the story she has built spatially (**Figure 4.38**).

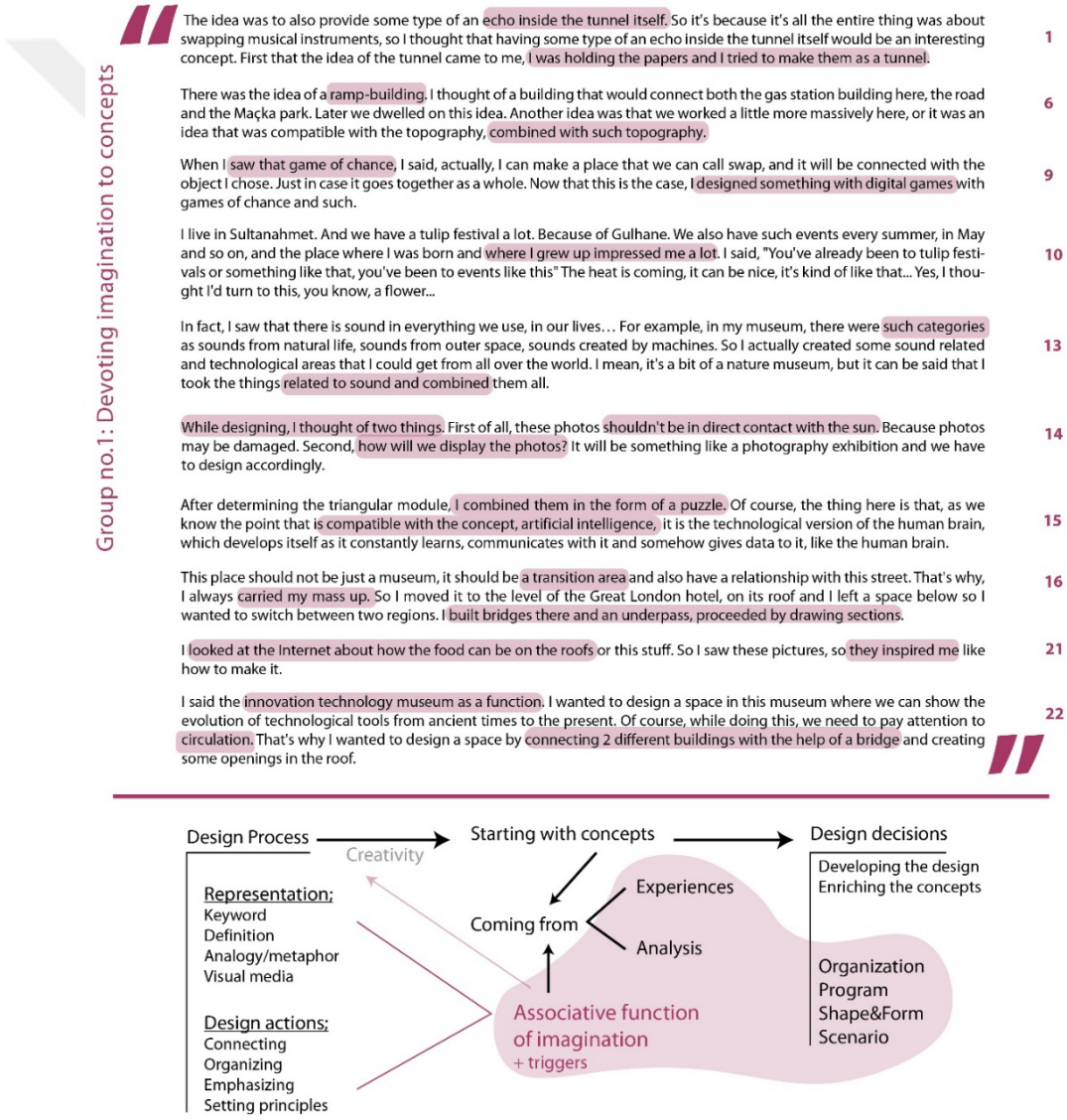

Figure 4.38 : Group no.1 samples and design process diagram.

It is possible to reach the following conclusions with the examples categorized and examined within the scope of Group no.1.

- Students start the design process by determining a concept as a result of their analysis and experience.
- The concepts they determine allow the other concepts in their minds to be related and they create a concept set as a design decision.
- Concepts may be related to form or space, as well as shaping the program and setup of the design.
- Identified concepts become determinative for the student to make design decisions in the later stages of the design process.
- It is aimed to provide students with this practice as a targeted approach in all processes from the first to the fourth grade in architectural education. For this, it is required to establish relations with different notions during the conceptual design phase.
- Students attribute their creativity to the concept creation and spatialization processes.
- While the students included in this group create their concepts with keywords, analogy/metaphors, and definitions, they diversify their design decisions with visual representation media in the following stages.
- Associative function of imagination is primarily used for all examples and students in the group, but the state of being constant in the group is seen as a result of the interaction and mutual triggering of associative function of imagination with other functions of imagination.
- Although design actions such as connecting, organizing, emphasizing, and setting principles focus on the representation of conceptual design, actions such as experimenting, testing, adapting, and forming are also important for communicating with other functions of imagination to construct this group.
- Unlike the first graders, it is seen that the 4th graders set up the concepts more for the form of the building and the context in which they are located. At this point, associative and iterative imaginations are maintained together.

4.3.2.2 Group no.2: combining imagination with others' imagination

Students in Group no.2 use designs created by other people's imaginations to stimulate their own. Researching and experiencing exemplary designs and projects is seen as one of the main approaches of the students in this group. In order to produce the new, this group of students first conducts research and examination of examples to determine the boundaries of their focus. The spatial and conceptual features that they intuitively determine from these examples are separated, associated and synthesized in their designs. 11 students who were found to be included in this group establish their design approaches with the act of exemplifying and keyword of “example”. It is investigated how three students from this group, who can be summarized as those who create the new by combining the information gained from the examples while making decisions during the design processes and developing their designs, use their imaginations.

The first example from the group that developed its design with examples is one of the first-year Turkish female students (imaginer-20) (**Figure C.20**). When the student was asked to explain the design process from the very beginning, the first point she started to explain was the process where she referred to the examples. She described the process as; “In the project, at first, I never understood what I was going to do. After that, by looking at who did what in the class, I actually did some research on Pinterest and created my own”. Beginning with that, she combined her design with the inexperience of being in first grade, and it is clear that she attempted to determine the boundaries of the problem from the start. However, even though it seems problematic from the very beginning of the process to limit herself to examples and what others do, the student saw this process as an opportunity for herself. The student presents an experimental approach to the process, where looking at the examples (**Figure 4.39**) at the beginning can be considered a trigger. Although she has improved her design with examples, she learns the spatial characteristics, organization schemes and construction techniques from the examples she looks at, sees, and tries to combine them in various ways in her project. However, it is understood that the student is not aware that she is so dependent on the examples and looks at them as a necessary design action. At this point, the student uses associative and iterative functions of imagination. She focused on creating combinations while synthesizing the information she received and creating

alternatives while producing to experience the examples she saw. Such diversification of imagination can be shown as an example of the versatile operation of this group.

The student stated that she used examples from different scales in the process. She stated that she did not understand the design problem and tried to determine the scope for the solution with the notes she took and the conversations she had with her friends. She then concentrated on collages and visualization experiments. This focus is appropriate for understanding the relationship between abstract and concrete concepts. At this point, the process that is progressing in the form of an exchange of ideas leaves its place as in Pinterest examples of model making, which is the next stage. The student stated that she wanted to see what could be done in this process and continued by experiencing the examples she saw in the model. Associative function of imagination is employed when she tries what she sees and begins to add her own ideas to it. This allows the student to bring her imagination together with other's imagination. The student emphasizes the importance of the criticisms received by the course instructors, stating that she always focuses on producing something unique with the directions she gets. With the experiments she produced and the scale differences she developed from general to detailed, the student brings together her ideas with examples at every stage of the process. In this case, she alters her approach, which she regards as analogy and adaptation, in order to generate new ideas. She became aware of her imagination at this point.

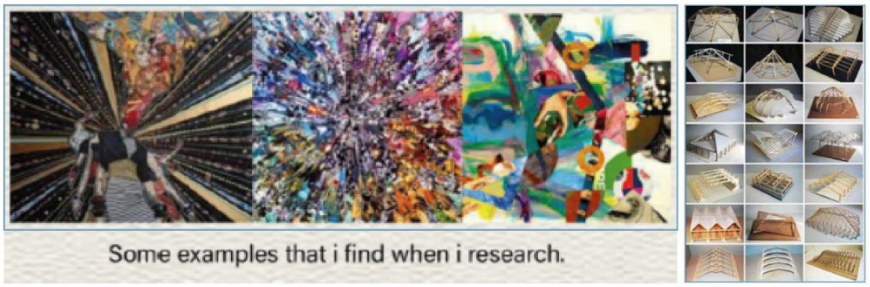

Figure 4.39 : Imaginer-20's research on abstract collages and model making.

Apart from seeing the examples as a trigger, another first-year Turkish female student (imaginer-17), who was considered a different approach within this group, evaluated the examples more clearly as decision-makers in the design process (**Figure C.17**). She claims that at the start of the project she researched to understand the problem and the solution. While the atmosphere she created in her mind with the notions she determined became spatial, new problems arose. In the solution to this problem, the

student sees and distinguishes the solutions for her idea in the examples and includes them directly in her design. With this approach, the student applies the modeling technique she sees in her design. The student, who focuses on the atmosphere and tries to combine it with the emotion she has chosen, claims that she is unable to reflect on what she is thinking during this period, which limits her decision-making mechanism. This statement can be explained by the student's dedication to examples and external factors.

The design process of the student becomes more complicated with this approach and the deficiency she sees in herself. As it can be understood from the word cloud created, the student felt the need to frequently use words such as “tried, thought, example, make” in the interviews. It is understood that the student attempted to do the same as the examples, but in the later steps, she made various attempts and detailed changes in order to apply the atmosphere in her mind. These changes, however, are radical decisions that result in new experiments with modeling materials and various design decisions in their drawings. The difficulty she experiences in implementing her decisions, which she sees as a defect in herself, can be evaluated as a potential. While the student uses associative and iterative functions of imagination intensely, the experiential function of imagination becomes dominant with the effort to reflect the atmosphere. At this point, it is tried to bring together the examples she sees and the features of the atmosphere she wants to create in the context of building technique and to benefit as much as possible from the ideas of the lecturers (**Figure 4.40**).

Figure 4.40 : Imaginer-17’s changing physical models according to criticisms.

While imagination of the previous student came together with different examples, this student shapes her design with a single example through the modeling technique. At this point, the student's use of acts of comparing/choosing based on the examples she saw at the start of the design process, as well as renewing the act of forming based on

the criticisms received, is critical for the use of imagination. Later, the search for spatial equivalents draws attention during the model-making phase.

As a third example, the design process of one of the fourth-grade Turkish male students (imaginer-2) is discussed (**Figure C.2**). In this case study, which can be considered as proof of the importance of sample analysis in the fourth grade in architectural education, the student performed the site analysis while starting the design. With the site analysis, he recognized the area to work on and determined what he could focus on in the following stages. As a result of the analysis, it is seen that the student accepts the construction around the site as an example. In this context, his first interaction with others' imagination is included in his analysis. When the student went to the conceptual design stage, the student said, “When I looked at the examples I researched, I always saw something that stood out. I saw the project stages. I saw something that stood out, that expressed itself” and emphasized the importance of examples in the conceptual design process. With this statement, it is understood that the student is trying to see the approaches that he can develop in his design by analyzing the projects created with others’ imagination. Unlike the other students examined, it was determined that in this group, the student did not aim for examples, but saw them as a tool and used them to expand the scope of his imagination.

Considering the student's imagination mapping, the initiating effect of "exemplifying", one of the design actions, draws attention. This action is a trigger for the student and the following act of “inferring” guides the design. It is seen that the representation media he uses is concentrated on the physical model. Although he uses the physical model as an experimental form development tool, it also has a different potential as a platform where the decisions made as a result of the analyses are applied. It is possible to say that dismantling the examples stimulates the student's imagination, increasing both associative and iterative functions. At this point, the student attempts to adapt the approaches and design processes that emerge in the examples he examines to his own design. However, it is possible to say that he did not use examples directly, but rather performed a conscious elimination and incorporated it into his concept. The word "example" stands out in the word cloud because the student used examples to describe the design process. This situation corresponds to the form decisions made and emerges as experimental studies in model making. The student, who stated that he decided to proceed with triangular forms, made his first decision about the form. Later, he aimed

to expand the design process with triangular-shaped examples. In this case, he researches the potential of the triangle with the examples he saw during his design process and the criticisms he received. This approach provides important data about sample analysis in architectural education. Evaluation of the student's analysis and synthesis ability through examples is since the instructors in architectural education direct them to examine the properties of examples rather than imitating and adapting them directly. This approach allows students to combine the use of imagination in others' approaches with their own imagination during design processs (**Figure 4.41**).

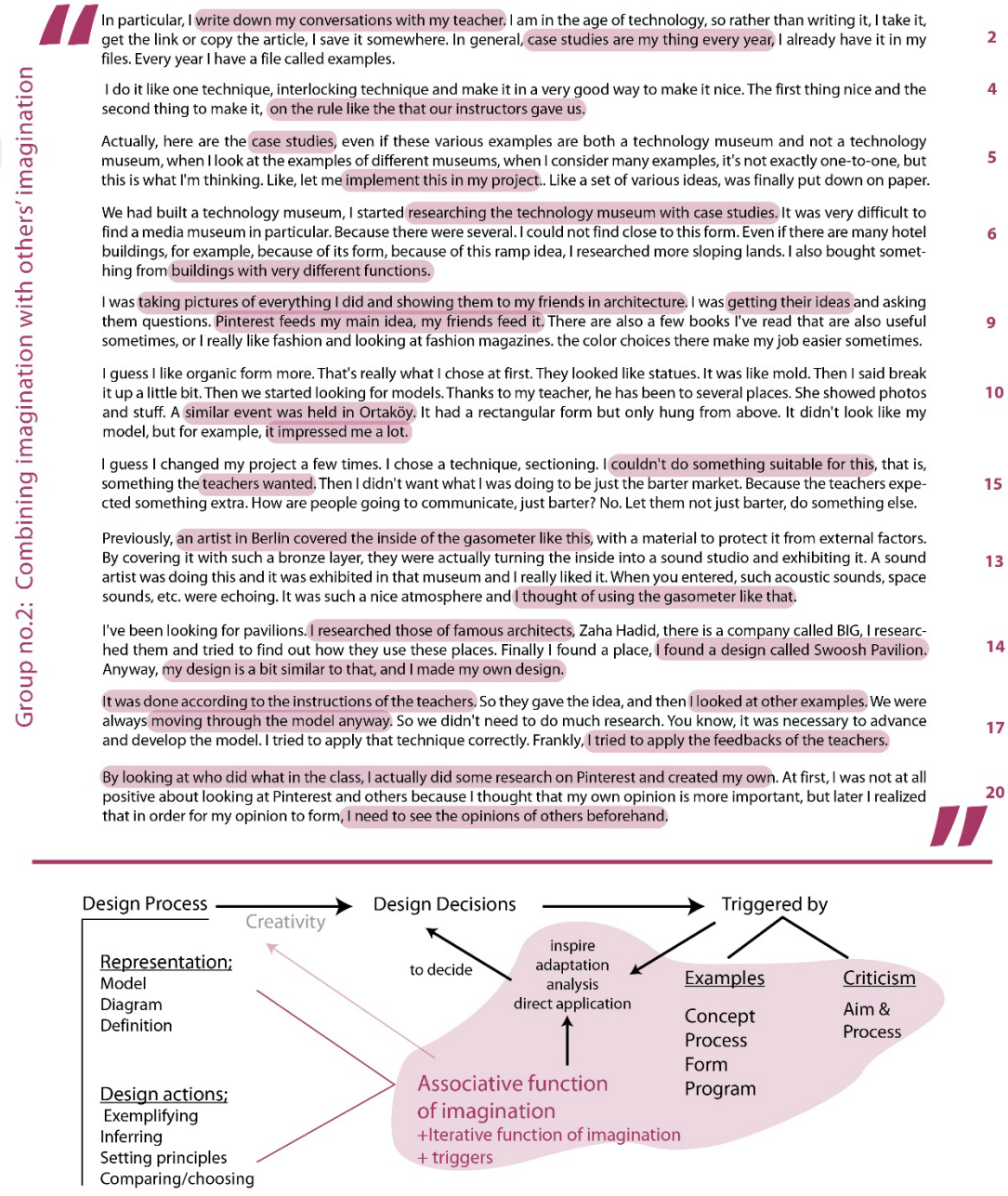

Figure 4.41 : Group no.2 samples and design process diagram.

In the light of these examples, it can be said that group no.2 includes the following approaches.

- The group focuses on exemplary projects, the productions of other students, and the criticisms of course instructors.
- The situations that this group focuses on are decisive at the beginning of the design process and then intensify at the stage of detailing the project.
- Students consider the examples and the criticisms they receive as a trigger for making a design decision.
- There are differences such as direct application, adaptation, or analysis of the researched examples during the design process. It is a big factor in making the decision to create the form.
- Actions of exemplifying, inferring, setting principles and comparing/choosing are intensively processed in this group.
- Although no definite limit can be defined in representation media, verbal expressions, diagrams and experimental models for research and analysis come to the fore.
- While this approach intensifies to make sense of the problem and solution in first grade, this approach becomes a design tool towards the fourth grade. Sample analysis and ability to infer gain importance during undergraduate education in this group.
- While it cannot be linked to a specific function of imagination, associative function of imagination is common in synthesizing the student's idea with examples, and iterative function of imagination is in conducting experimental studies based on examples and criticisms.

4.3.2.3 Group no.3: seeking the limit of imagination

Students in Group No.3 develop their design ideas through trial and error, constantly making suggestions in their designs from the beginning to produce new ones. Students, who are aware that the design process never ends and that everything can change, consider their designs as if they are in the process of an experiment. Trying to blur the boundary between what they can produce and what they produce is made possible by

attributing an experimental approach to their designs. Experimentation in this context can be both intuitive for students and represented by design tools within a causal organization. Working by producing alternatives or working by producing with a more concise definition is observed as the primary factor in the relationship that this group establishes with the functions of imagination. According to the interviews with the ten students in this group, they are production-oriented and derive new meanings from what they have tried.

The first of the students included in this group is a fourth-year Turkish male student (imaginer-14) (**Figure C.14**). Although he begins the design process with predetermined design features, it can be said that he employs representation tools with an experimental approach. The student, who began the semester intending to create a different spatiality each term, stated that he had decided to create a structure consisting of triangles without sharp edges this semester. However, when the student began to deal with the form, his restricted approach opened up new possibilities. He stated that he experimented with different things based on the lecturers' instructions, aside from experimenting with triangles to create spatiality. Although these trials concentrated on the first two weeks, they were eliminated because they could not adapt to the atmosphere he wanted to create. When the student realized that his progress with triangles would construct the spatiality he wanted to provide as he first imagined, he began to investigate the properties that the triangle could have. In this case, he began to experiment with alternatives of triangles and tried to visualize the image in his mind with various drawings. The limitlessness offered by the alternatives of triangles can be evaluated as a reflection of the student's iterative function of imagination. However, the proportionally dominant associative function of imagination of the student shows that the student's approach does not depend only on his experimental studies. The unifying attitude of associative function of imagination toward deduction allows different approaches to design to be brought together and questioned. At this point, iterative and associative functions of imagination support each other, revealing an experimental design process.

When the student's design process is examined through imagination mapping, it is understood that he made decisions with certain definitions at the beginning of the process. However, the fact that his design decision was to use only a triangular form necessitated an experimental approach. Deciding on the placement of the programs

with various analyzes, the student started his experiments on the combination of the triangles in the plan. When the student realized that the spatiality he had imagined did not materialize when he carried the borders drawn in the plan and layout to three dimensions, he tried again with triangles. Diversification of representation media becomes important at this point. Because the student draws the plans in an oscillating process between the physical and digital model. These interacting representation media also increase the diversity of the student's design actions such as decision making, choosing and experimenting. The student realizes the problem that he cannot see in the plan drawing and continues his experiments in the model. In this case, it can be said that perceptually different approaches are exhibited when the transition between the representation media increases, and thus the alternatives multiply. The relationship that the student establishes between the representation media and his actions reveals the dialogue that the iterative function of imagination establishes. He tried to establish a mathematical rule for the union and dimensions of triangles. The student's effort to organize his experimental work can explain why he tried to establish this simultaneously with both the plan and the model. As the words in the word cloud indicate, the goal was to establish both the concept and the form with triangles. The development of the whole design decision around the triangle form, from the landscape to the concept, can be explained by the student's associative and iterative functions of imagination searching for the limits and the dynamism of triangle.

The second example is a first-year foreign female student (imaginer-3) (**Figure C.3**). Although she sees experimental work as necessary, she sees it as a goal rather than a design approach. This imaginative approach has not become a habit consciously, but it can be attributed to first-grade education. The student began the design process by conducting concept-oriented experiments. These experiments were combined with experiences from her daily life, but she tried to develop other concepts with the guidance of the lecturers. She stated that it was difficult for her to decide on her own, as she considered this change in the concept as a glitch. However, although the student seems to be externally dependent, her experimental approach came to life with her intuitiveness. She appears to be experimenting with her design decisions before considering the referrals. The design process of the student, which is read from the design diaries, where she comes to the lesson almost two days a week with different model experiments, diversifies and the spatial fiction that she has built in her mind is

formed in different alternatives. At this point, the student's effort to perceive the place she dreams of comes together with the effort to spatialize the stories she constructs in her mind. She demonstrates how iterative function of imagination, nourished by experiential function of imagination, pushes the limits of creativity.

Differentiating from the design process mentioned in the previous example, the alternatives shaped by the atmosphere and scenario form the student's relationship with the actions of forming and narrating (**Figure 4.42**). It can be seen from the student's imagination mapping that she tries to define and clarify her design with various stories. Considering that experiments become physical with changes in design, what allows the student to choose between alternatives is whether she has created an environment suitable for the story formed in her mind. This situation concentrates on visual representation media such as collage, perspective, and physical models. While producing, she evaluated her design from scratch according to the criticisms she received from her environment and lecturers, which shows that her experimental approach is not transformative. As the alternatives increase, she sees different things and strengthens her story. As seen in the word cloud, the concentration of the word "think" can be interpreted as the search for the fiction created in the mind of the student and its reflection. In this case, the student produces plan drawings and models with stories that offer different spatiality. Awareness of working with alternatives in first-grade education can be considered an important approach. The fact that the concept or story provides the transition between representation media in this case demonstrates that iterative function of imagination is crucial for this group.

Figure 4.42 : Imaginer-3's trials and errors with physical models.

Another example is a first-year Turkish female student (imaginer-12) (**Figure C.12**). Unlike other first-grade examples, she attributed the reason for her experimental approach not to external factors but her instability. While starting the design process,

the student chose a modeling technique and carried out her experimental studies. In this process, she tried modeling techniques and then tried to create different perceptions with the materials she used in the models. She stated that it is easier to produce different alternatives rather than advance an idea. In this case, it is possible to say that the student uses iterative function of imagination intensively. Working with alternatives increases the student's ability to choose among what they produce. However, the student also carries out the design process alternatively in this example. She stated that she has developed three different approaches and that design is formed with different inputs and ideas within them. In this context, the student considers the entire design process as an experimental phenomenon and establishes the limits of imagination through the differences in the design process.

The student stated that in the first attempt of the design process, she created an image in her mind and tried to make a model of it. She claimed that she was thinking while constructing the model for the second experiment, and that the design in her mind became clear at that point. In the third experiment, she stated that after imagining an image, she created the model in a digital environment, controlled it from there, and accepted it as a finished product. These three approaches show how the design process can differ alternatively. This diversifying process of the student shows itself in the differentiation in her designs. This situation causes the student to keep iterative function of imagination at the forefront and to reveal new designs both in her mind and in her models. The student differs from other students in making the design process alternative, rather than experimenting with models using different techniques and materials. This is evident from the scattering of the function distribution obtained from imagination mapping. Because her design and process were reset with each attempt, and its iterative function of imagination concentrated it three times. At this point, the relations she established with different representation media and her actions drew attention. It is understood that she first made a design decision with a verbal expression and made these decisions while forming the model, and then decided that it was not appropriate with the inferences she made. The next iterative function of imagination comes into play with the perspective drawing of the space that she envisions in her mind. The reflection of this on the model is also modified in the simultaneous mental representation with the act of thinking. In her last attempt, it is observed that she thought, produced and finalized it with a digital model. Although three different

projects shorten the design process, the student's multiplicity of production makes this process an unexpected phenomenon. Beyond three different approaches to those who develop their designs by working experimentally, it is seen that this experimentation has become a habit, especially from the first grade to the fourth grade. In both classes, it is possible to say that this group was formed with iterative function of imagination and became dynamic with the multiplicity of representation media and design actions (**Figure 4.43**).

Figure 4.43 : Group no.3 samples and design process diagram.

The characteristics of this group can be expressed as follows as a result of the interviews with the students.

- They work experimentally to clarify the fuzzy decisions, but they keep the basic decisions or conceptual analyses they made at the start of the design process until the end.
- The attitude and direction of the lecturers and the abundance and diversity of the examples seen are the determining factors.
- The simultaneous or sequential use of different representation media strengthens the experimental approach. In this context, the structure of architectural education that directs the frequency of representation used and production gains importance.
- Design actions such as forming, experimenting, choosing, and testing are the main actions that establish the student's design process experimentally.
- Ensuring hand-eye-mind coordination enables comparison and selection among the alternatives of the designed space through external representation.
- Students see this approach as a barrier to decision-making, but they are also aware of the potential for perceptions to broaden.
- Experiments on modeling technique, material, form, detail analysis, and organization become more intense as the design process progresses.
- The effect of iterative function of imagination on generating alternatives and experimenting with the process is clearly visible. Other imagination functions are in positions that enable decision-making in this group. In this context, working with alternatives ensures that the representations are diversified in terms of producing the new and that the design is perceived as an experimental environment.
- The 4th grade students continued their iterative function of imagination with different design actions on a single representation medium within this group. In contrast, the first graders combined their experiential imaginations with different representations.

4.3.2.4 Group no.4: multiplying imagination with design decision

Students in Group 4 consider every step they take in the design process, whether instinctively or consciously, as a rule or design decision. It has been determined that when students are assigned rules, they engage in activities such as establishing context, making inferences, and approaching the solution by establishing causality in their design processes. When the design processes are examined, it is seen that the act of "inferring" gains importance for this group. Although this design action is considered a mental representation, it also determines the physical structure of the design due to the connections established. Students' design decisions are influenced by these established connections. In this case, decisions regarding both concept and form become more frequent. Apart from the inferring action, it is explained by the students attributing a reason to all the design decisions produced by this approach. The fact that 14 students make design decisions by establishing relationships and connections with different imagination functions shows that design thoughts are based on a cause-effect relationship. This cause-effect relationship creates imaginative links and is sought in representation media.

The first example is one of the first-year Turkish female students (imaginer-7) (**Figure C.7**). “I started by thinking about where the project was going to end and knowing that the steps have to be connected, with the smallest things reaching a conclusion” statement proves that the student's imaginative approach is included in group no.4. The student starts the design by planning the whole process and thinking that all the decisions she will make in the process should be interconnected. The connection between the choice of emotion, which is the example given by the student, and the spatiality expressed by the collage, shows that the design proceeds with this causality even at the conceptual design stage. The student's proportional use of associative function of imagination is related to the act of inferring. Since associative function of imagination provides the actions that connects and brings together in design thinking, making inferences and approaching the design in the cause-effect connection enables the student to increase their imagination in this context. The fact that she tried to support causality with her experimental approach and stated that she was experimenting with materials and settlements provides the emergence of iterative function of imagination. The fact that she detailed the decisions she made and reproduced the decisions she made in line with a single form decision show that the

transformative function of imagination is also causally triggered. The attitude of the student, who always treats it as if she lived there, shows the existence of experiential function of imagination. In some cases, her design decisions are compatible with the causality of the fiction she has established for her design. For example, the student said, “I was thinking through the plan to compare its positioning. But then to decide on that positioning, the plan just was not enough. Because I can only look at it from above, but I did not know how to walk in it, for example. That is when I switched to 3D thinking”. As she stated, she establishes causality to test her perception and design through representation media (**Figure 4.44**).

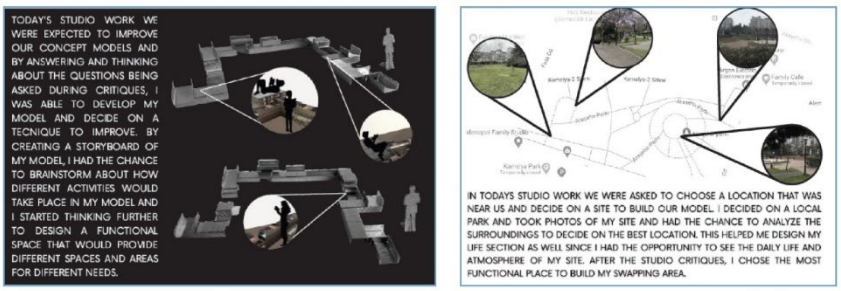

Figure 4.44 : Imaginer-7’s brainstorming and causal thinking process.

When the student's design process is examined in the context of imagination mapping, it is possible to observe that associative function of imagination emerges intensively due to the concept created. She experimented with visual representations and processed her decisions as a result of inferences as minor improvements as she began to imagine herself there. In this context, the student's rulemaking act and cause-and-effect relationship situation strengthen the link between imagination functions. As it can be understood also from the word cloud of the student, who stated that these connections have been ongoing since the very beginning of the design, she constantly questions her design decisions by asking herself questions or taking notes. The density of the words "think, question, create, make, and process" can be described as based on the questioning of the design approach and provides this situation by thinking and producing. Although the student used various representation tools while providing these, it should be emphasized that diagrams are important in this group. Mental schemata that focus on connections manifest themselves as diagrams in external representation. The answer given by the student to the question in which she finds herself creative can be considered a summary of the whole grouping. The student said, “I always felt creative while thinking. As I said these questions already because it is

my favorite process. It made me feel highly creative to see the possibilities of things that would emerge after connecting them. My favorite process was asking, so what I enjoyed most was getting different things by connecting them". The presence of the acts of questioning, thinking, and connecting that she expresses through her sentences causes the student to remain committed to the design process. Being aware of this and adopting it as a situation that enriches imagination makes it possible for the student to evaluate the design from different perspectives while increasing the use of imagination.

Another example is one of the fourth-grade Turkish male students (imaginer-6) (**Figure C.6**). This student's process is similar to the example described earlier. The importance of the act of inferring in this group can also be read in this example. However, the process is longer and more complicated since it is the fourth class. The student believed that he should shape his design by producing new decisions from general to detailed, so he valued the decisions he made during the design process. The student started the process by analyzing and making sense of the site. Even during the analysis process, the student made design decisions and, as a rule, combined these decisions with the synthesis of the information he had acquired. The student, who stated that he worked in Maçka park, made case studies about the technology museum and associated his ideas with what he saw earlier in his life. While it is notable that the term synthesis is frequently used, this indicates that the student employs associative function of imagination comprehensively. The situations he analyzed in the park form a cause-effect relationship while shaping his project. For this, he first determined the rules by diversifying his thoughts and then the design tools. While the idea of "ramp-building" creates the student's concept, it provides a set of rules for the form of the design, as well as being an analogy/metaphor. After examining the potential of the concept and related examples, he synthesized them by site analysis and introduced various rules. This set of rules has been tried to be solved in every design problem encountered throughout the process.

The physical model indicates that the student began the design based on the analysis with the assistance of associative function of imagination. It is understood that he sees the physical model as an environment where he gains new information and incorporates it into his analysis, rather than seeing it as an experimental tool. He emphasized the rules he saw in the model and attributed the reason for making

decisions as keywords within the framework of his analysis. The student, who stated that he/she worked and thought through diagrams, made experiments for the layout scheme but continued the ramp idea that he has determined as a rule in his mind. Due to his efforts to ensure the continuation of the park, a single rule he determined lays the groundwork for other rules to be established. He drew perspective drawings and plan drawings to see the spaces he created in the diagrams within the site. These drawings are evaluated in a position that directs the student's imagination within hand-eye-mind coordination. While expressing the images formed in his mind with drawings, he stated that he has solved them by putting new rules on the problems he encounters. He was able to establish a more creative environment by synthesizing the other information he had acquired and working on his design as alternatives by diversifying the means of representation. Since he is in the fourth grade, his tendency to use computers can also be considered a practical reflection of his analytical thinking style. He stated that he can make decisions quickly with the influence of digital modeling tools in the later stages of the process and he has made this practice a habit. Digital modeling tools enable the setting of rules or the definition of new rules that will continue the "ramp-building" concept at the stage where transformative function of imagination, including landscape and façade, comes into play. At this point, the student tested his rules experimentally and moved towards the solution. As can be seen from the student's word clouds, the analysis of the site is an important trigger factor. The most prominent emphasis on the word “thought” shows the multiplicity of the student's mental productions. The concentration of mental productions on inferring as an act of design also proves the causal approach, which is the main feature of this group. While he stated that even the types of pencils, he uses make sense, he also stated that sketches, which are the most important means of representation, play a significant role in his perception of the space he creates. This situation enables the student to determine the rules at the point where he puts the image in his mind on paper or to make a choice on the subjects to focus on.

If we continue with the fourth-grade students, the design process of the Turkish female student (imaginer-5), who is included in this group with a similar approach, is examined (**Figure C.5**). While describing the design process, the student stated that she first researched how to build a museum and chose one of the concepts she discovered. The student proposed an interactive museum by inferring and starting from

the needs of the museum based on the concept she developed, and she stated that she considered this to be a rule. She later stated that she was experimenting with various representation media and design actions, but she considered this interactive situation as a problem. This interactivity established the spatial features of the design with the concepts of continuity and navigation. The student said, “As separate masses, I aimed to somehow connect with the audience and provide an uninterrupted tour from the moment the visitor steps into the museum. Then I aimed to get the visitor out by walking around all these areas and visiting all the parts of the museum fully equipped, and I started by preparing this thing for the tour while I was building the masses”. In this context, it is possible to say that the student made decisions within the framework of the concept she has determined as in the previous example. While she stated that she considered the space as masses and its parts, she also emphasized that it should be an interactive and dynamic place. This approach of the student, combined with associative function of imagination, has a more uniform density of functions of imagination than other examples. This situation can be explained by the fact that the student made simultaneous experiments, tried to maintain the concept of wandering, wanted to perceive the space within the tour, and caused changes in the space with the rules she determined.

The student's imagination mapping is also a reflection of this multifaceted study. The situation of producing solutions based on the concept, which starts with associative function of imagination, continues by determining the rules related to it in the following stages and applying the rules in the section drawings. At this point, although it is known that she tried different alternatives with perspective drawings, iterative function of imagination shows itself at each stage where the rules are devoted. However, in this example, unlike the others, it is the effect of experiential function of imagination in assigning a rule as a determinant. The student narrates the rules she has tried and applied with stories/narrations. Because the spatial features she wants to create match the concept of navigation and define a flow. She used rearrangements to solve the new problems she identified in the reflection of the space she experienced and narrated during the tour. However, the student tries to narrate it each time she sets a new rule or works experimentally. Therefore, the stages in which the student sets the rules or makes design decisions are related to the story she has built, and causality is tested through this story (**Figure 4.45**).

With these examples, it is possible to specify that commonalities occur for group no.4 as follows.

- It is possible to say that architectural education provides an orientation towards the causal approach through the three examples mentioned. Design processes, which are connected to reasons and provide continuity, come together with other imaginations. This coexistence enables experimentation and the realization of different forms of perception.
- Actions of inferring and setting principles seem to provide continuity in design processes. Imagination functions that support inference before or after the actions that provide this continuity are diversified.
- Associative function of imagination and other imagination functions are triggers and cause design decisions to connect.
- Design decisions taken are for the form or the concept, as well as each decision, is assigned as a rule and is kept until the design is finalized.
- While the early established rules are represented verbally, the later rules are related to vision and perception and are developed with models or drawings. However, this group is nourished by diagrammatic thinking and working with diagrams.
- Experimental productions lead to selection by establishing a causal link between alternatives. This situation is reflected in the process as a design decision. Beyond that, experimental studies remain minimal, and developments are made on a single design/form.
- Causal design practice plays an active role in architectural education depending on the use of diagrams. It is seen towards the fourth grade that causal relationships extend to the process rather than individual decisions.
- It is seen that students question their thoughts at each design step and use these inquiries as a tool to test their design decisions.

Figure 4.45 : Group no.4 samples and design process diagram.

4.3.2.5 Group no.5: focusing imagination on a single design

Even though the students in Group no.5 share characteristics with group no.4, it has been determined that they exhibit a detail-focused approach without making design decisions. As a result, this set of approaches can be defined as a group of students who

advance their designs to the finals to develop and elaborate on the design processes in general, as well as to elaborate on the new product they have produced. With this approach that focuses on details, it is discussed as developing design problems through a single solution rather than taking a design decision. The main feature of this group is that the form or the image that comes to mind at the beginning of the design process is expressed with the same image at the end of the process. In this context, 11 students act with the image of the design they focus on and create for the first time, and they refrain from making radical decisions and working experimentally. In fact, this situation reveals the students' ability to produce partial and detailed solutions. The crystallized structure of the images in this group draws attention to imagination. This crystallized state is established by the dominance of transformative function of imagination.

Based on the examples in this group, it is clear that the approach of one of the first-year foreign male students (imaginer-4) concentrates on a single production as well (**Figure C.4**). It is noteworthy that this student differs from all other students and uses transformative as the primary function of imagination. It is thought that the main factor behind this approach is that he describes the design process as a finished product. During the interview, it was determined that the student's ideas on the criticisms he received, and thus the productions he created, were targeted towards finalizing the design. The decision he made for the concept while he was still at the beginning of the design process is developed as a single alternative. The minor changes he made in the framework of the concept reveal the general design approach of him. Likewise, the geometry and volume he determined for the form were created at the very beginning of the design process. While it is important to note that changes are ongoing, making additions and subtractions, adapting to the context, and testing the student's modifications offers minimal radicalism. This situation prevents working with alternatives and spreads throughout the design process as a reflection of transformative function of imagination.

The student associates the process, which he believes is the most creative, with the satisfaction he received from the final critiques. Therefore, when imagination mapping is examined, it is understood that the transformative function of imagination, which concentrates on the final, represents the rate of focusing on the details. The student shaped the form of his design with various representation tools and design actions and

made design decisions with diagrams and physical models. However, design decisions are incorporated into the process without continuity. In this case, the student's design process demonstrates a path of preserving the decision about the form he took on the physical model and then modifying that form. The student expressed his thoughts on the design process being experimental as follows; “For example, in this project, some friends said, “no, I will just make it two times and that is it”. But no, we cannot make it like that. OK, it is maybe better if you don't work, but in the end, I need great results for my work. That's why I'm still working, and, in the end, nothing is perfect. As architects, we should always work, and we can always improve. Like even the huge towers or the huge buildings, you still can improve it and still make some changes on it”. The student defined design as a process open to development, learning, and working. In contrast to this definition, the student's design approach, which is primarily based on change, exemplifies an extreme point of this group’s scope.

The approach of one of the first-year Turkish female students (imaginer-8) reveals a similar situation (**Figure C.8**). The reason why it is examined as an example is based on the short answer she gave when asked to describe the design process. The student stated that she had difficulty understanding the design problem, and couldn’t fully grasp what is wanted, and this affected the whole process. She did not specify an action or tool related to design thinking in her process description and explained it with this sentence; "Later, I developed my project by following the criticisms given by my teachers. So, I can say that the result partially satisfied me, but it could have been improved. I can summarize my process in this way". This situation demonstrates that she has a focused approach to the final product and instructors' criticism. The student's testing method is described by dividing the path to the solution of the design problem into what is desired and what is done. In this way, the student can be associated with iterative function of imagination and has an experimental approach. The student, who claimed that even the trials took the form of a single image in her mind, only started over at the points where she was unable to connect them to the idea of joy. Therefore, the student differs from the previous example and develops her design for the image and atmosphere in her mind without a single rule.

It is noteworthy that design actions and related words such as “think, tried, made and change” are concentrated in the word cloud. The connection between her thoughts and what she produced is embedded in the change-oriented design process. The things she

wrote as a reminder to herself in the process that she started with verbal expressions constitute the analysis stage of the design. Although this approach to the concept makes itself clear in an experimental process while creating the form, it has been determined that the volumes produced by the student with models do not contain radical changes. It is considered important data that she stated during the interview that she never started the design from scratch and what she thought and drew was similar to each other. In this case, her ability to crystallize what is in her mind can be attributed to her avoidance of radical changes. This approach, which does not give much opportunity to question, causes the student to make only minor changes (**Figure 4.46**) in the later stages of the design process. Although the model's potential is limited to a single production, matching what she sees with what she thinks attributes the student's imagination to creativity focused on details. Creativity in this case is expressed in the interviews as a situation that the student is also aware of. The student stated that she believes she differs from other students because of the small details she included in her design. For example, after placing her design on a sloppy site, attempting to adapt it here appears to be an effect of transformative function of imagination on design problems in detail.

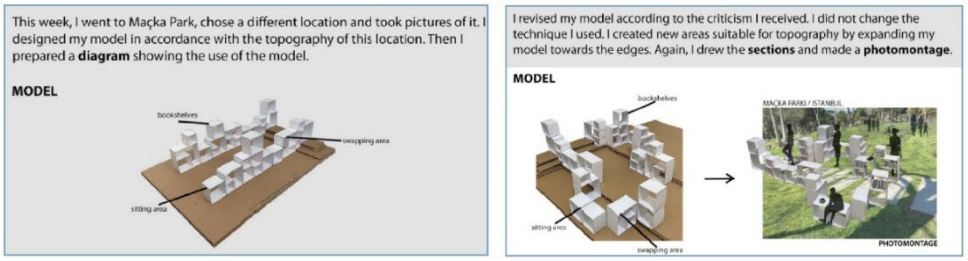

Figure 4.46 : Imaginer-8's adaptation of her design to topography.

In this group, one of the fourth-year Turkish male students (imaginer-18) was examined as an example of a different approach beyond the effect of the physical model (**Figure C.18**). This example also focuses on a single design, but transformative function of imagination is in third place compared to other functions of imagination since the process is carried out in a more complicated way. The student stated that at the beginning of the process, he tried to adopt what was required within the scope of the course. Even this statement shows that the student determined his goal in the final product depending on what is desired. It is possible to say that in the following stages, he worked with a more planned scheme compared to the approach of a first-grade student. Accordingly, the student continued research to make analyzes based on the

site and concept which is a green roof and building-park connection. He expressed the information he gathered as a result of his analysis with various means of representation. At this stage, it is determined that he has established a relationship with associative function of imagination. He directed the analyzes he determined and the concept design he created for the future to a single production. The student created a spatiality in his mind as a result of his analysis and decisions. At this point, the examples that the student saw contributed to the formation of the image in his mind. Then, the student created the layout and programs by considering the design as a diagram. The student who stated that he was working with plans at this stage described the design as having a diagrammatic form. In the later part of the design process, the effect of transformative function of imagination is directly compatible with the use of digital models. He stated; “Then after a layout came out slowly after I made zones. I slowly started working on real dimensions, not on sketches. After that, I started to switch to 3D design. I started drawing in 3D. After that, I went down to more plans and more details. I tried to figure out how each field would work. I tried to unlink the connections". The process he mentions provides an understanding of the environment in which the student describes the changes he makes in the layout he draws.

The stage at which the student attempted to make the aforementioned connections corresponds to the actions of testing and emphasizing in imagination mapping. These design actions are evaluated within the practice of production offered by the digital model. The student has defined design as an experimental process at the point where transformative function of imagination comes into play, and the process is not designing from scratch, but testing changes and making choices accordingly. He stated that the digital model provides an environment to test the image in his mind and that changes are sufficient to solve the problems he sees. This creates a transitional process between plan, diagram, and digital model. It is seen that design actions such as rearranging, decision-making, and changing come into play in each transition. In this case, the student responded to various modes of representation through a single production, resulting in iterative and associative functions of imagination. The spatiality established by the student led to the emergence of words such as “think, look, try, model and drawing” as seen in the word cloud. The student thought, created in his mind, then simultaneously tried what he had in his mind in the digital model and developed it with various drawings to finalize it. The vision of the future produced in

the formation of the concept caused the student to establish various connections in his mind. These connections are explained spatially as a green roof or building-park connection. At this point, the design decisions he made differed from the approach of first-year students. The imaginative approach, which is more intertwined with group no.4, differs in that the determined decisions become sparse but create an image of the whole. The student stated that he has completed the design process by making minor changes to the spatiality. Accordingly, the design decisions made by the student affect the changes not as a rule, but as a spatial feature that should be emphasized, and provide a connection between associative and transformative functions of imagination.

In this case, if group no.5 is summarized with its features, it can be itemized as follows (**Figure 4.47**).

- At the beginning of the process, they make a design decision for the concept or form, this design decision remains the same until the end of the process.
- The focus is on producing a finished product rather than the design process itself, and planning is done accordingly.
- The effect of perception and vision is emphasized, so visual representation tools and especially models gain importance. This situation may vary according to the practice of using analog or digital tools from first grade to fourth grade.
- It includes an analysis process from the whole to the details. In this context, students aim to reach the final product with design actions such as modifying, adapting, adding, subtracting, and testing the new ideas they have produced in their approach to design.
- Crystallization of the image created in the mind and focusing on the details with the changes made during this is determined by the students in the group.
- Depending on this group in architectural education, the goal is to change the design, reveal its potential, and strengthen established connections.
- Transformative function of imagination is actively involved in the process to develop the new and offers an innovative approach to details.
- Students' imagination supports creativity to intervene with minimal solutions to the design problem. At this point, determining the features to be emphasized

beyond experimental studies gains importance in the design and establishes differences.

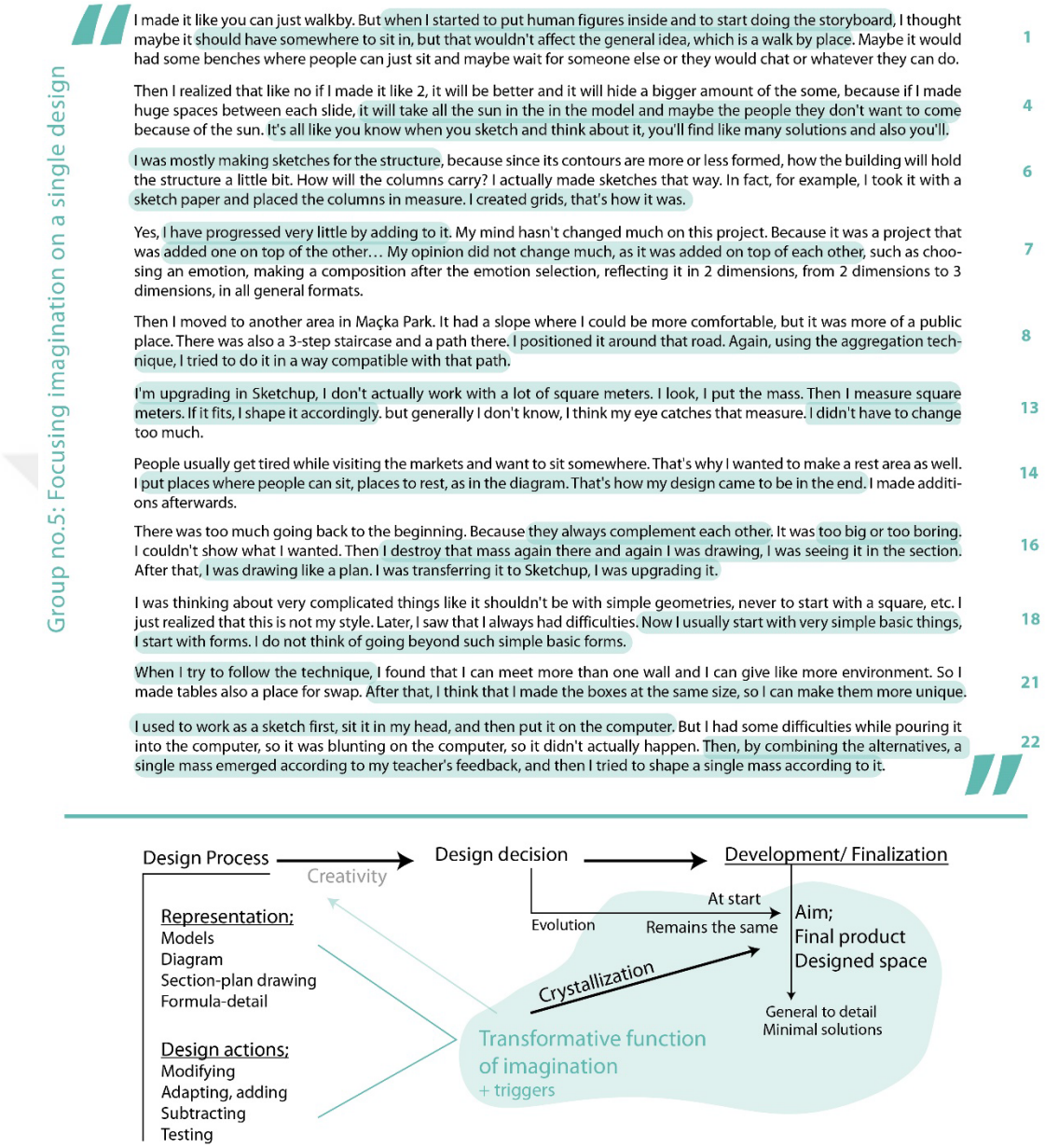

Figure 4.47 : Group no.5 samples and design process diagram.

4.3.2.6 Group no.6: using imagination as narrative

Students in group no.6 create images in their minds by adding life to their designs. These images can be evaluated as a method to produce the new. With this method and approach, students narrate their designs by associating them with a living environment. The narrated spaces are developed with the descriptions and features they contain and directly target the designer's experience. This approach, which occurs with the effect of experiential function of imagination, is provided by considering the design in a flow.

In this context, the students included in this group describe the use, activities, programs, movement, materials, atmosphere, and all living phenomena of the space they designed. Because these definitions overlap with different representational environments and design actions, students experience what they see on the site as a common approach. As a result of the interviews, this situation, which 10 students stated that they focused on during the design process, determines the scope of the group.

The first example to be examined for this group is a first-year Turkish female student (imaginer-10) (**Figure C.10**). The student used iterative function of imagination extensively depending on the experimental work through the design process. However, the facts that the student considered as a design decision had traces of her own life. Although the stage of deciding on the form and concept became clear towards the end of the project, she stated that she shaped her design within the framework of the concept. With her trials, the student referred to the alternative production feature of the iterative function of imagination, stating that she focused on the form and ways of using the space. Here, however, the focus of her empirical work is on experience and perception. Therefore, alternative design suggestions are related to the student's own experiences. At this point, while searching for an alternative, the student activates associative function of imagination with the decisions she made based on the concept and her experiences. Stating that she first positioned her project in Sultanahmet, where she lived and grew up, she emphasized that her analysis consisted of her own experiences. It is understood that the project's location as a concept, as well as the flower concept, which it deals with due to its location, combined with her own experiences and caused her to convey the process as a story from her own eyes. In this context, experiential function of imagination affects the student's design process and presents storytelling based on associative function of imagination.

When the student's design process is examined using imagination mapping, it is clear that her experimental studies continued and that she attempted to make a design decision using collage and keywords. Afterward, the student activated her own experiences with the flower exchange area and positioning in Sultanahmet, which are the decisions for the concept she took (**Figure 4.48**). She conveyed each of the design decisions and changes she made as a process after this phase, and in some cases, it is determined that she offered a solution to the design problem by narrating it. “I live in

Sultanahmet, and we have a tulip festival. Because of Gulhane, we also have such events every summer. So, the place where I was born and where I grew up impressed me a lot. I said, "You've already been to tulip festivals or something, do these kinds of events". Since I live in Sultanahmet, tourists visit these places a lot. At first, I wrote about the place Sultanahmet. I thought it was something that tourists come and see, let's not close everything for circulation, let people come and see what's going on", she explained the decision-making process and showed how the circulation is solved with storytelling. It is possible to say that the storytelling, which she combined with her own experiences, began when she stated that when she placed the spatial organization, she designed in Sultanahmet, it created an image in her mind. She tried to revive her design with the photoshoots and collages she made during the process, describing the spatial features she focused on. The fact that the concept is based on her experiences and that these experiences support the story she has created has caused the student to make a different production, as can be seen from the word cloud. Her development of hanging flowers from above rather than on the ground, describing the atmosphere she wanted to create with the materials she used, and wanting to give character to her design with the name she used for her project shows how experiential function of imagination comes together with iterative and associative functions of imagination. The student explained her scenario with the words: "I was trying to make it as fun as possible. I was trying to make it as fun as possible. I know it didn't belong to me when I said, "It's morning, you're going to do something soon, you need to open up for the swap" but such storytelling, my presence in the event, and being the main character was important. For example, I manage everything, people come, and I greet them with a smiling face. It was constantly running like a summer drama". This answer summarizes the student's approach, and her adoption of this practice opens up a discussion that it is a self-existent skill.

Figure 4.48 : Imaginer-10's design proposals according to her experiences.

Another example is one of the first-year foreign female students (imaginer-14) (**Figure C.14**). While the student is describing the design process, she stated that she wanted to do something different from the others. For this, she chose the object of photography as the item to be exchanged, instead of clothes or books like everyone else did. While describing this choice, the student said, “I thought that not only would old photos be exchanged, but people would also be telling each other the story of that photo while exchanging old photos. First, I went and researched it at home. I tried to find old photos, and the oldest photos I could find were photos of my father when he was younger, from the 80s or 70s or something. I found them and put them in the project. First, for example, I found a photograph of my father from the war. I thought, well, if we trade this with someone, we'll tell the story of it and we'll add something to it, he/she will learn something from us. And maybe I'll have learned something from him". Because the swapping object is a story and is regarded as important data, it is clear that the student relates the experiences as a story and associates this with the photograph. Both exchanging the stories and narrating the swapping activity appear as a design decision. After the student created her concept about swapping, she determined the need for it. This is an approach developed by the student to match the fictional story with reality. The fact that she chose nostalgia as the desired emotion is a fact that supported the atmosphere of her story. It is seen that she brought the concepts of nostalgia and photography together and revived her design. At this point, the student used associative and experiential functions of imagination both when creating the concept and when making design decisions based on the concept.

When we look at imagination mapping of the student, the media such as collages, stories/narrations, and analogy/metaphor also symbolize the representation media that this group is associated with. The student conducted various research during the design process and compared herself with the approach of other students. This comparison is made possible by perceiving the design as a story. The subjects she focused on, primarily the exhibition and preservation of photographs, established the form of her space. Later, the features of the structure, which she attributed to the “umbrella” shape, emerge within the framework of this description. Additions and adjustments focused on the human and defined a movement scheme. The student tried to make decisions about these relations with the diagrams she made. Trying to differentiate her design at every stage and using it as an act of representation in the diagrams or models she

produced shows the efficiency of her iterative function of imagination. Because she internalized the story she has constructed, she associated her imagination with being experiential in even the smallest decisions or changes she made to her design. The fact that the most important phenomenon in this design approach is circulation, it shows that the student developed her story around movement. The definition of the entrance, exit, and activity areas of the people with diagrams and the processing of these areas by describing them in the mind led to the development of the design. It is critical at this point to convey the commitment to the concept and the atmosphere created by the concept as a story. The process she conveyed for the colors she used referred to the concept of nostalgia and took place in the story as a determining factor in the emotions of the users. Even while testing her design towards the end of the process, she focused on the atmosphere of the space and the feelings it will create. It is necessary to emphasize the collage technique she developed as well as the significance of placing the design in the field with photomontage. As can be seen from the word cloud, the student has established a human-centered approach. The interview, in which words such as “photos, people, different, thought, want, and design” come together, shows that the concept created by the student's design approach is narrated and a different design is desired to be created in her thoughts. At this point, the student focused on her experiences and created a spatial fiction guided by her feelings and perception (**Figure 4.49**). The spatiality she created for the sitting area from the design decisions she made also emerges as a situation that she put into her story based on her experiences. Video production, which is the representation tool she used, connects with the concept and provides a cinematographic perspective. This approach created an environment for the student to experience the design that she narrated. In this case, it is possible to say that the student considered her own experiences as a story and combined her design with other imaginations within the story's fiction.

Figure 4.49 : Imaginer-14’s storyboards according to her design decisions.

The interview with one of the fourth-grade Turkish female students (imaginer-13) differs from the previous examples because of her approach within the group (**Figure C.13**). This distinction is due to other students' associations with the stories. In this case, the student's design approach consists of mentally experiencing the space she designed. While this method demonstrates a diagram of the design process, it also describes the method of solving the design problem in the student's mind. The student said, “What if I were the one who went there, I was thinking what would I see? If we are designing this, I thought, what would I want if I were the student there, or what would I want if I visited the museum? I thought about what would be boring from what I saw, what I couldn't see, what I would like, what would excite me, etc.” The activity that enables her to make a decision is matched with her perception of the story or in the process that enables her to experience it. In this case, the student established what-if connections and presented a fragmented approach to the design. This fragmented approach activates the iterative, experiential, and transformative functions of imagination, which is similar in intensity to associative function of imagination. Therefore, the student integrates storytelling into the process as a design tool and evaluates all imagination functions in this context.

The relationships she established while creating her concept and the decisions she made in reflecting on the form were considered important by the student. However, the student stated in the interviews that she tried to experience the spatiality she wanted to create in the background of her mind as a design practice. The student said, “I didn't make a storyboard, but the sketches I made were describing the places. For example, if I'm in a restaurant, I sketched it. Now I'm out of the restaurant, I'm on the ramp, it's like I've sketched the ramp. I tried to make sketches of the place that I designed and went in my mind”. The student stated that she used her experience there as a design tool in the connection between the representation media and the design thought. The fact that the concept directly targets the senses enabled the design decisions to be considered together with the atmosphere of the space. However, the student claimed that her design process was intuitive and that she perceived the space she created as a mass. The student used the experience of the space she has designed as a testing tool and included design actions such as "animating, narrating, and delineating" in the process to sense the space. As it can be understood from the word cloud, the concept of the museum designed by the student is decisive, while the drawings she used and

the images she created in her mind caused her perception to shape the design. The student said, “I was thinking about how I could implement the ideas in my mind. When you implement it, I wonder if such a thing really happens here.” The thoughts she conveyed show the relationship she established between reality and the spatiality she created by narrating. Therefore, this approach of the student creates a similar pattern in other fourth-grade students and shows the connection of the orientation covered by this group in architectural education with reality. This approach can be followed in Figure 4.50 and can be examined within the design process diagram.

Figure 4.50 : Group no.6 samples and design process diagram.

Due to the samples examined, the following conclusions can be drawn for group no.6.

- In the design process, storytelling provided by imagination has a pervasive and dominant attitude that is related to the way of thinking.
- Its purpose is to allow the user to experience and perceive the designed space. The human factor is stated to be the most important component of the design at this point. It was discovered that the students produced with their own experiences. Through storytelling, the produced spaces are narrated, and keywords such as memory, time, and actors are revealed.
- It is seen that the student group, who design by storytelling, expresses design actions such as “delineating, animating, narrating, and experimenting” with representation media such as collage, drawing, video, storyboard, stories/narrations, analogy/metaphor.
- The focus is on the atmosphere of the space to make a design decision and to elaborate the design. At this point, the relationship with the concept gains importance.
- The connection established with real life can be explained by the effect of imagination establishing a dialogue between the past and the future. Students combine their previous experiences with the applicability of the spaces they design as a testing element.
- The concepts of activity, circulation, program, movement and living are regarded as the primary components of the space.
- Experiential function of imagination is in a position to support other imagination functions and dissipates in the process. The effect of the experiential function of imagination working in the background and the image of the space experienced in the mind can be observed in the design.
- Architectural education encourages the use of imagination as a causal tool in narrative construction. In this case, students analyze the fiction they created, bring them together with their designs, and realize that these fictions are problem-solving tools.
- It is seen that the use of narration and storyboard is more clearly included in the first-class architectural education due to the practice of including the

phenomena such as atmosphere, emotion and narrative in the design process. However, this situation becomes more internal in the 4th grade and it has been determined that the students visualize their designs in their minds thanks to the experiential function in the act of thinking.

4.4 Results

The design diaries examined explained the scope that first-year architecture students established between representation and imagination functions. The case study conducted with first- and fourth-year architecture students enabled comparisons between design processes and determination of differences or similarities. Thus, the role of imagination functions in design thinking was investigated with students at different stages of architectural education and with different approaches. As a result of this research, the existence of patterns, differences and common behavioral groups was observed. The findings show that common patterns can be established and the repetition of different approaches among students can be grouped into specific behavioral patterns. In this context, it is possible to claim that students employ functions of imagination extensively in the design processes, and it is acknowledged that the functions support and trigger each other, and act concurrently. Therefore, the effect of representation media and design actions is important in architectural design practice. Students also diversify the scheme of use of imagination functions with the transitions they establish between representation media. The fact that almost all of the students use both verbal and visual representation media shows that they use different functions of imagination. The use of design actions, which can be approached causally as well as intuitively, can also be examined in this context. The representation media and design actions accompanying students' decision-making processes shape their imagination mapping. Therefore, each process becomes unique, but also creates common patterns. The instances, which are handled and studied in six distinct groups, also diversify the differentiation in design processes and, as a result, the combination of functions of imagination. In this case, it has been determined that the students do not adhere to a single function of imagination, and it is understood that imagination, which is included in the design process in different intensities, is the main factor that establishes the essence of design. It is seen that students' imagination mapping exists independently of their achievement status. This situation is observed as an indication

that architectural education does not only offer an evaluation based on creativity. However, the common patterns and common behavior groups of imaginative approaches of the interviewed architecture students gain importance in architectural education due to the bond they establish between representation and imaginatiıon. As a result, the fact that functions of imagination, which are hypothesized in the thesis, establish commonalities and grouped approaches in the design process through representation is supported by interviews. Furthermore, the idea that imagination is not a singular phenomenon and that diverse representation associations generate different approaches related to imagination is explained using examples within the groups. The diversity and commonalities that imagination develops in the context of its relationship with representation media and design actions demonstrate the effect of imagination on the architectural design process in this context. This situation also shows that the diversity and combination of representation media and design actions focused on architectural design education from first grade to graduation can reveal design approaches based on imagination functions.

5. CONCLUSION AND DISCUSSION

The purpose of the thesis, "Imagination in Design Thinking: Tracking Through Representation," is to highlight the importance of imagination in design thinking by revealing the commonalities and differences established by functions of imagination in the context of representation in different design processes, as well as the relationships and features inherent in imagination. In the thesis study, it has been observed that imagination has a place in a variety of research such as philosophy, neuroscience, psychology, and art. This multi-layered and versatile structure of imagination becomes significant when determining its place in design thinking. The potentials of the multi-layered and dialogic structure of imagination in design thinking establish the structure of the study as the main motivation of the thesis.

Within the scope of the thesis, imagination has been deconstructed and its four functions in design thinking have been highlighted. Various functions of imagination acquire new meanings during the design process. As a result, imagination has been studied as an ability that diversifies the design processes by combining the different functions it contains. These functions define the range of imagination in design thinking as associative (observing the relationship established with memory), iterative (establishing the basis of production and alternative thinking), experiential (providing the focus of experiences and experimentation), and transformative (assuming the innovative role of change and transformation).

Design thinking is discussed in the context of design processes, design inputs and outputs, design approaches, problem-solving, creativity and representation. Different approaches to the design process are seen in architectural design literature. At this point, the design process is discussed neither with a completely intuitive nor completely systematic approach with a path, but with a holistic and in-between approach as an alternative to design literature with the effect of imagination. When viewed with an alternative approach within the framework of imagination, it has been revealed that imagination functions are included in the design process as common patterns of imagination and common behavior groups of imaginative approaches. As a result, the thesis' main focus is to deconstruct design thinking with the attitude of

imagination that both directs and is affected by the design process, and thus to question the role of imagination in the production of design ideas.

The subject of representation, which is one of the parameters included in the design process, has been redefined in the context of imagination. The role of representation in the design process has been investigated in response to the question of how imagination is represented. In this context, research on mental and external representation have been carried out in order to follow the path of imagination and to reveal how it is represented. Mental representation is discussed through the schemata created in the mind of the designer and the relationship between schemata and imagination were considered critical. As defined in Schema Theory, the schemata in the mind of the designer are constantly changing and transforming, new information is articulated, and gains an experiential approach according to the design decisions related to imaginative approaches.

The cognitive process of schemata formation is linked to external representation and allows the designer to engage imagination through representation. Within the scope of the thesis, external representation was investigated with both verbal and visual media under the name of tools and design actions. Therefore, the object of representation and design action in which the representation is created takes place in the thesis as a reflection of imagination. In this context, imagination and its four functions are included in the design process with mental and external representation. With the concept of representation, new and original design knowledge was sought, and it was discussed within the scope of the thesis how the four functions of imagination form the design process.

In order to reveal the place and potentials of imagination in the design process, a relationship diagram was established through representation. Accordingly, this relationship diagram has emerged in which the concepts related to the design actions that emerged in the process of using mental and external representation and the concepts related to the imagination functions were brought together. With this diagram, it has been evaluated as a coding system to show how imagination offers design approaches through design actions and representation media and to track imagination of the students who are participated in case studies of the thesis.

In order to discuss the connection between imagination and representation and its place in design thinking, the first phase of the case studies focusing on the design diaries of first-year architecture students and their use of representation were introduced. With this study, examples were given about which design actions can be associated with the representation media used by the students and how the design processes can be shaped by the effect of imagination when evaluated in the context of the created relationship diagram. Since a holistic analysis of the design processes of the students could not be made with only design diaries, in-depth interviews were conducted with the students in the second stage of the case studies. These in-depth interviews conducted with first-year (focus group) and fourth-year (comparison group) architecture students with different design characters and backgrounds. In this context, students' design processes were revealed with analyzes focusing on the functions of imagination and it was tested whether the imagination produced certain patterns or differences. The hypothesis that imaginative patterns, differences and common behavior groups are formed during the design process has been analyzed by coding the interviews with keywords, visualizing them, reading them in timeline, and revealing the intensities of imagination functions. These graphics, which are considered as mapping and describe the design process of each student individually, showed the transitions between imagination functions, and also revealed the keywords that build and trigger imagination.

According to these analyzes and the thesis work, interrelated causes and results shaped in the context of imagination have emerged and can be followed in a flow. In the context of imagination, the design process is not considered as a systematic or intuitive situation, but as a multi-layered and non-linear situation in between. While imagination enables ideas to be changed, transformed, articulated, reconstructed and experienced within mental representation, it enables the tracing of ideas in the context of external representation. It has been determined that design actions take place in line with the purpose of use of representation media and design approaches are established through their relationship with imagination. Imagination establishes certain patterns and common behavior groups within the design process as it is tracked within these representation media and design actions. These are associated with the potentials of imagination functions and nurture creativity. The potentials of the iterative and associative functions of imagination gain meaning in the design process in relation to the representation, action and other functions used and have a direct effect on the

formation of the design idea. With transformative and experiential functions, the design idea becomes perceptible under the influence of imagination and is considered as a tool for students to externalize their ideas. Although the students used the four different imagination functions in different intensities and sequences, it was seen that the imagination as a whole had a significant impact on design thinking. It was concluded that there were no significant differences in design approaches in terms of imagination between first and fourth grade students, but the fourth graders described a clearer process as a result of the development of design practice and representation skills. As aimed in the first year of architectural design education, it was observed that the use of different imagination functions increased with the use of different representation and design actions by the students. The common behavior groups that emerged as a result of imagination mappings are named as follows; devoting imagination to concepts, combining imagination with others' imagination, seeking the limit of imagination, multiplying imagination with design decisions, focusing imagination on a single design, using imagination as narration. It has been seen that transition and continuum are provided between a diversity of representations and imagination functions, thus making the design process dynamic.

The imagination mappings have revealed the limitlessness of the dialogues established by the students with different imagination functions, which reveal their creativity with various representations. In this context, the impact of the representation practice instructed from the beginning of architectural education until graduation on the design process, and thus how design thought formed around imagination, could be questioned. The effective inclusion of both verbal and visual external representation in the design process has revealed the multifaceted structure of architectural education. However, the issue of how the transition between these representations and the potential of these representations develops students' creativity is still open to discussion. Therefore, the fact that imagination builds the design process with the dialogue between representation media can be considered as an alternative education approach. The stratified structure of the use of representation has also divided the use of imagination into layers, and it has been determined that it is in continuity regardless of which approach is used in the production of the design idea.

It is considered that it is possible to investigate the link between verbal or visual representation alone and imagination within design processes and that it may be

incorporated into existing architectural practice discussions. Beyond that, even the establishment of design thinking with digital and analog representation tools shows how imagination functions are involved in the process. For example, while students' animating their designs as sketches, describing what is in their minds with metaphors, or experimenting with forms on a digital model illustrates the experiential function of imagination. Examining and disassembling these representation media separately demonstrates that the phenomenon of representation of both offers unlimited differences and establishes certain approaches due to the common imagination function. However, the important and decisive point is for what purpose the representation is made into action and with which function of imagination it creates the process. In this context, in the post-thesis studies, it is possible to deepen the scope of representation media and to detail the potential of imagination functions. Groups that emerge as a result of imagination in this case gain meaning within the scope of the thesis as situations that define design approaches and thus determine the design actions used, and they manifest themselves through the dialogue between representation media.

When a holistic view is provided of all mappings, it can be discussed that the design actions for the concept and the form predominate in architectural education, but the transitions and stratifications between them are left to the student's approach. At the same time, the fact that it is handled as a comparison between first and fourth grades creates the need to expand the scope of post-thesis studies. If it is determined which function of imagination or which grouped approach is targeted at which stages of architectural education are given in the interim periods, this will more clearly define the level of accumulation of students' design thoughts. However, within the scope of the thesis, the focus is on the raw approaches of the first graders, and it is investigated whether they have similar imagination patterns to the graduate students. At the same time, it is thought that the scope of imagination and common behavior groups will be reshaped with a study in which different cultures become more diversified. Even the fact that the student group interviewed and examined is being discussed with the project course taken online during the pandemic is thought to be effective in imagination mapping. Beyond that, an investigation into the design processes of professional architects using imagination scheme established within the scope of the thesis can be conducted. Herein, mapping is an important decision in the thesis study

to investigate the minds that are constantly changing, developing, gaining experience, and producing, i.e., the students' imagination. Therefore, it is thought that the inclusion of the approaches of the architecture studio course instructors in the research will provide a different perspective on the design processes in post-thesis studies. Thus, the subject of architectural education and imagination will be able to be detailed more holistically. However, within the scope of the thesis, following imagination over the representation subject with the expressions of the 1st and 4th-grade students, thus revealing the design approaches and questioning the thesis hypothesis can be considered as a preliminary step in the research.

Imagination is represented on a wide scale from our behavior in our daily life to the simplest design decision we take. This representation finds a response both mentally and externally. The mental capacity, which is constantly changing and developing with experiences, also nourishes imagination, thus expanding the scope of representation. In this case, the dialogic feature of imagination gains importance. With the existence of any function of imagination, the design process provides a foundation for creativity, and it both becomes unique and defines common approaches with the combinations formed within the process and examined with representation. In this context, the thesis aims to establish a new discussion on the practice of using imagination by emphasizing the importance of incorporating imagination into design thinking through the phenomenon of representation. As a result, it is thought that imagination should be discussed as one of the main focuses of design thinking as long as minds focused on producing and open to experience and change continue to exist. Because both architectural education and architectural practice will always maintain the potential to use creative thinking beyond problem-solving, and this is only possible with the dialogue that imagination establishes with representation. The possibility, sustainability, and method of establishing design approaches by being aware of the potentials of imagination and tracking it through representation in architectural education appear as a debatable question. In this context, the thesis contributes to the architectural design literature by deciphering this dynamism and the ways as common patterns and common behavior groups in which different functions of imagination are involved in the design process through representation and provides a flow for the use of imagination in design approaches and therefore, architectural design education.

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APPENDICES

APPENDIX A: Survey questions
APPENDIX B: Semi-structured in-depth interview questions
APPENDIX C: Imagination mappings of interviewed students

APPENDIX A

- Cinsiyet/Gender:
- Yaş/Age:
- İkamet Yeri/Acommodation Place:
- Hangi okullarda okudunuz?/Which schools did you study at?
- Hobileriniz neler?/What is your hobbies?
- Hangi derslere ilgilisiniz?/Which courses are you interested in?
- İlgili olduğunuz derste başarılı mısınız?/Are you successful in these courses?
- Katıldığınız kulüpler nelerdir?/Which student clubs have you joined?
- Mimarlık seçmenizin sebebi nedir?/ Why did you choose architecture?
- Mimarlık eğitimi dışında bir tasarım sürecine dahil oldunuz mu?/ Have you been involved in a design process other than architectural education?
- Bir işte çalışıyor musunuz ya da daha önce çalıştınız mı?/Do you work or have you worked before?
- Proje dersinize günde ne kadar zaman ayırdınız?/How much time did you spend per day for your project lesson?

APPENDIX B

• Can you describe your design process in detail from the very beginning, including your experiences and thoughts?

• How were your own experiences or knowledge included in your design?

• How are the representation tools you use involved in your design process?

• How did you represent what you thought at the conceptual stage of your design?

• When determining your idea, were there any additional resources that support it?

• Were there any moments when you worked by generating alternatives?

• Did you have any ideas about the atmosphere of your design?

• How did the inclusion of the human figure in your design affect your process?

• Have you made productions other than the assignments given in your design process? What did you do if you did?

• Do you keep a sketchbook? Where do your sketches concentrate on?

• Has your design had moments of change or transformation?

• What tools and systems did you use while transforming your design spatially?

• Which of the tools or methods you used in your design process did you feel more inclined towards? Why is that?

• Were there any missing points in your design process?

• What was the stage in your design process that you focused on the most and felt you belonged to?

• What do you think was your most creative time?

APPENDIX C

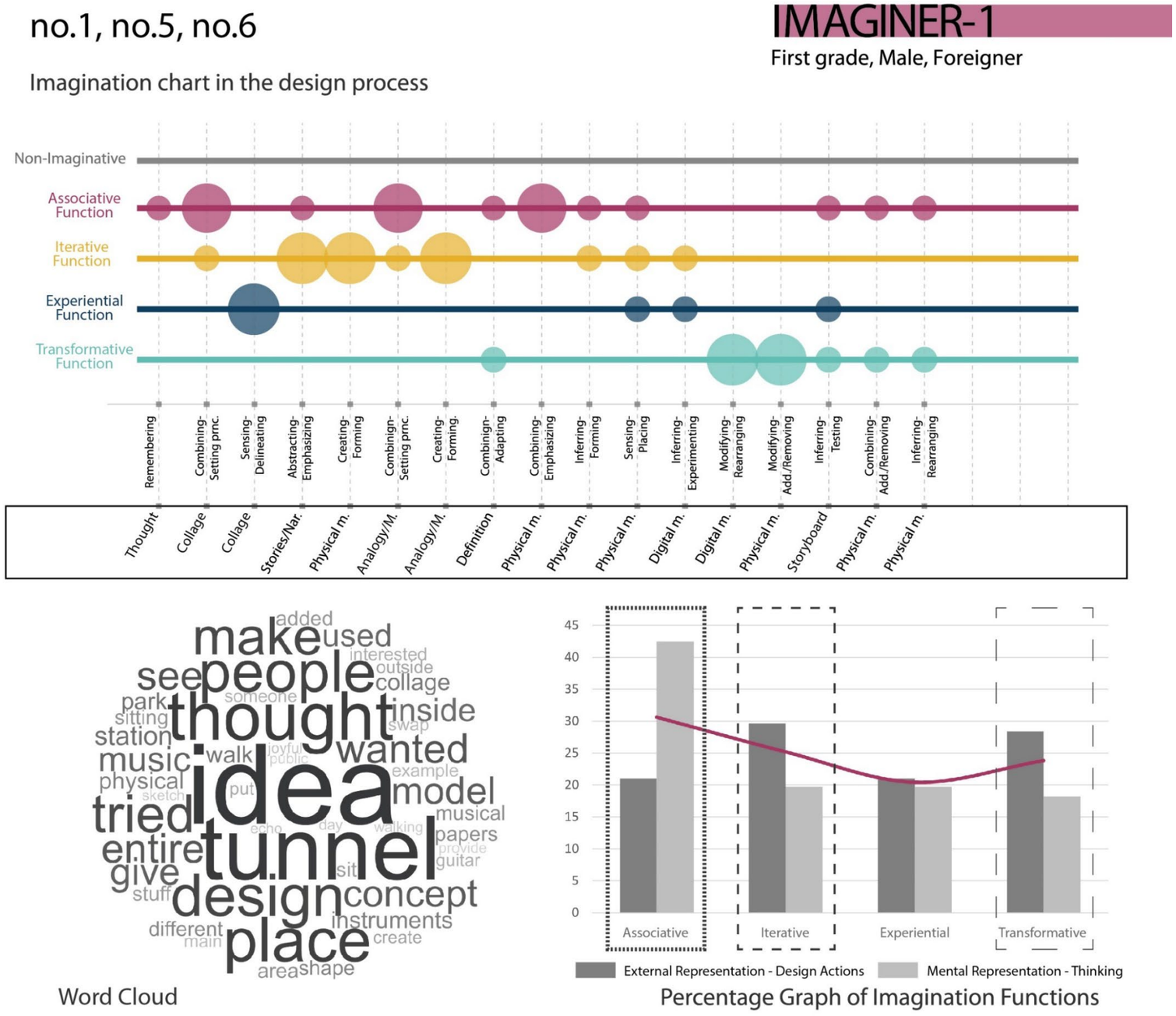


Figure C.1 : Imagination mapping of Imaginer-1.

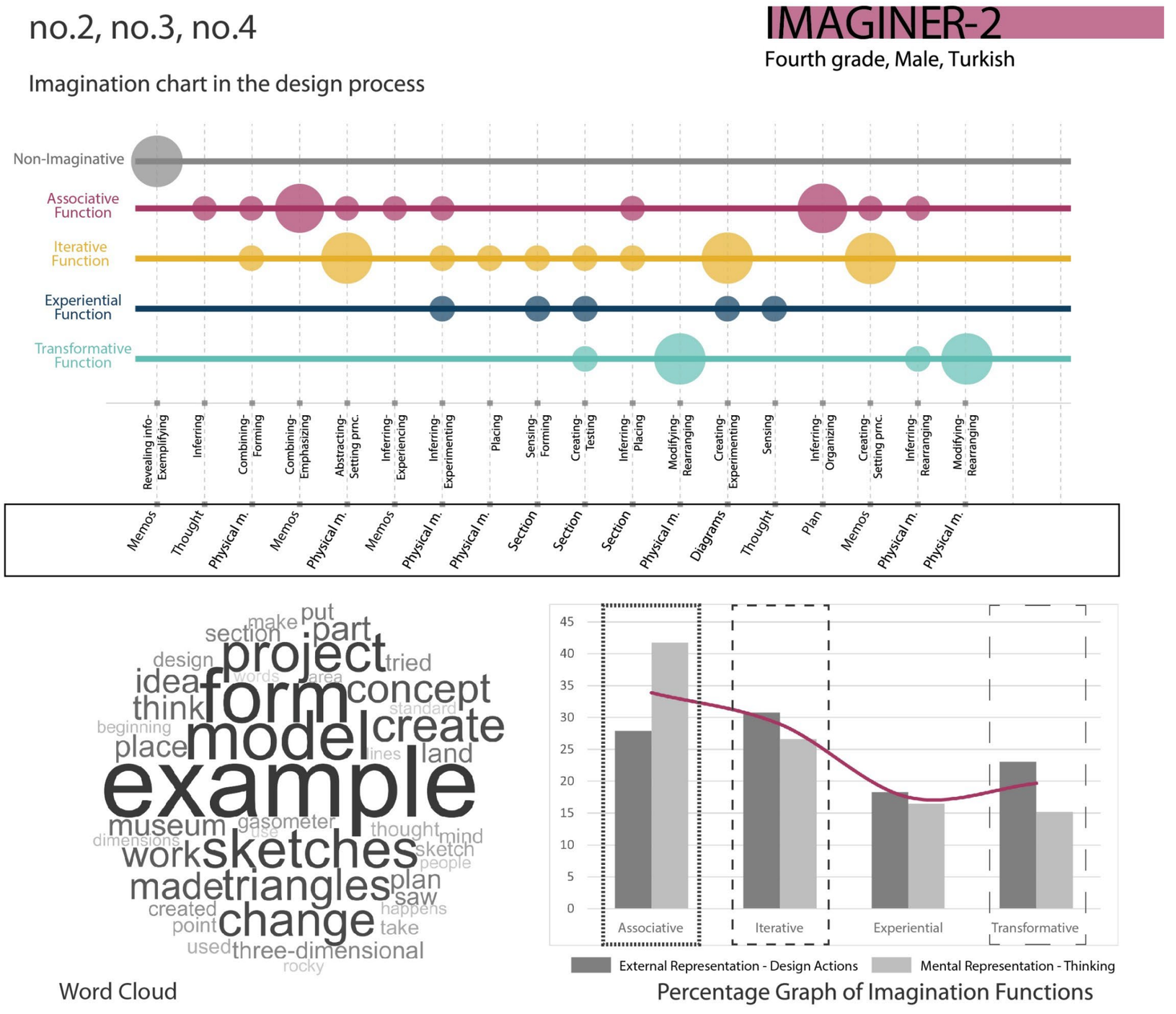


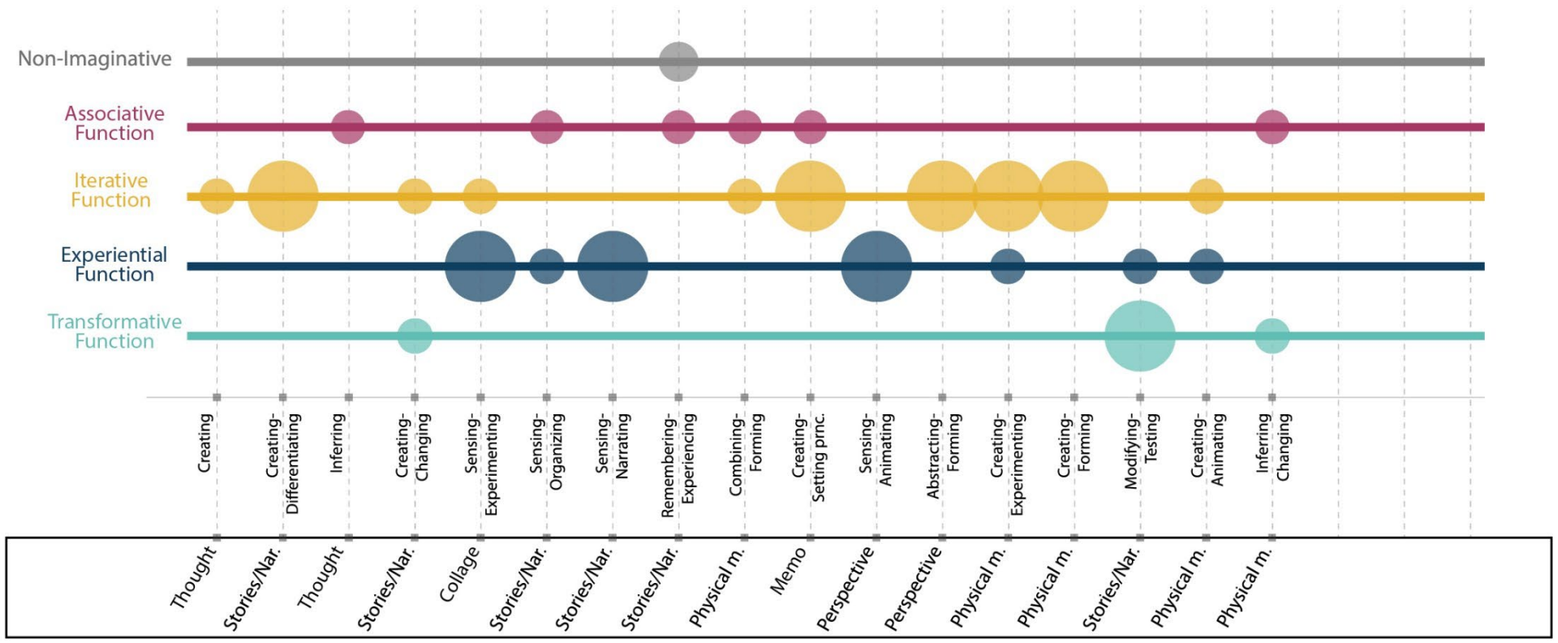
Figure C.2 : Imagination mapping of Imaginer-2.

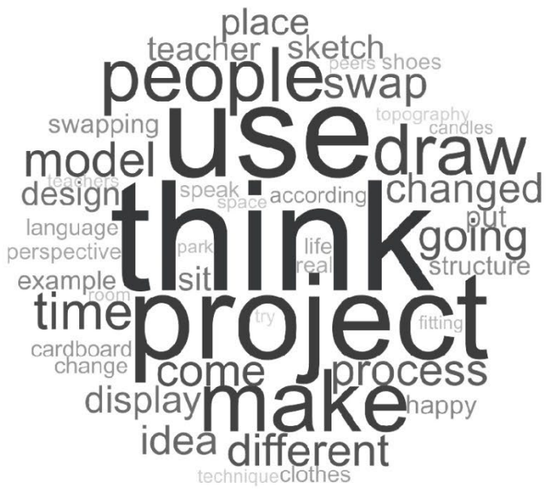
no.3, no.6

IMAGINER-3

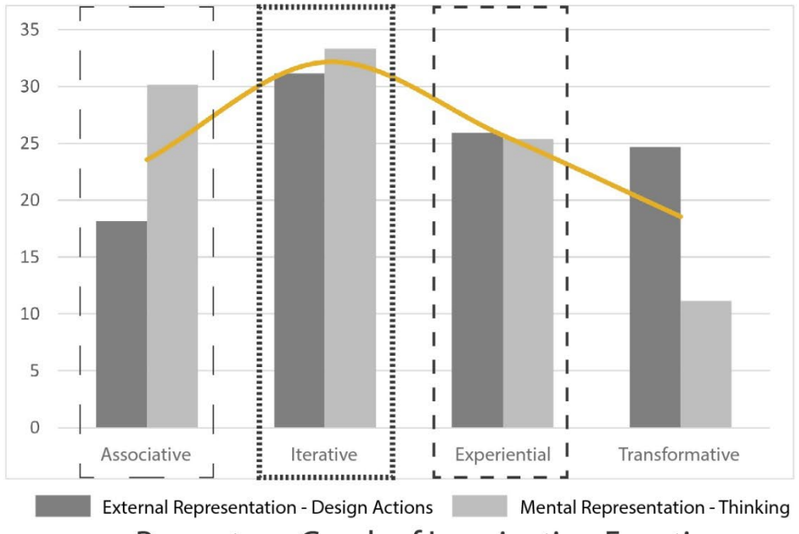
First grade, Female, Foreigner

Imagination chart in the design process





Word Cloud



Percentage Graph of Imagination Functions

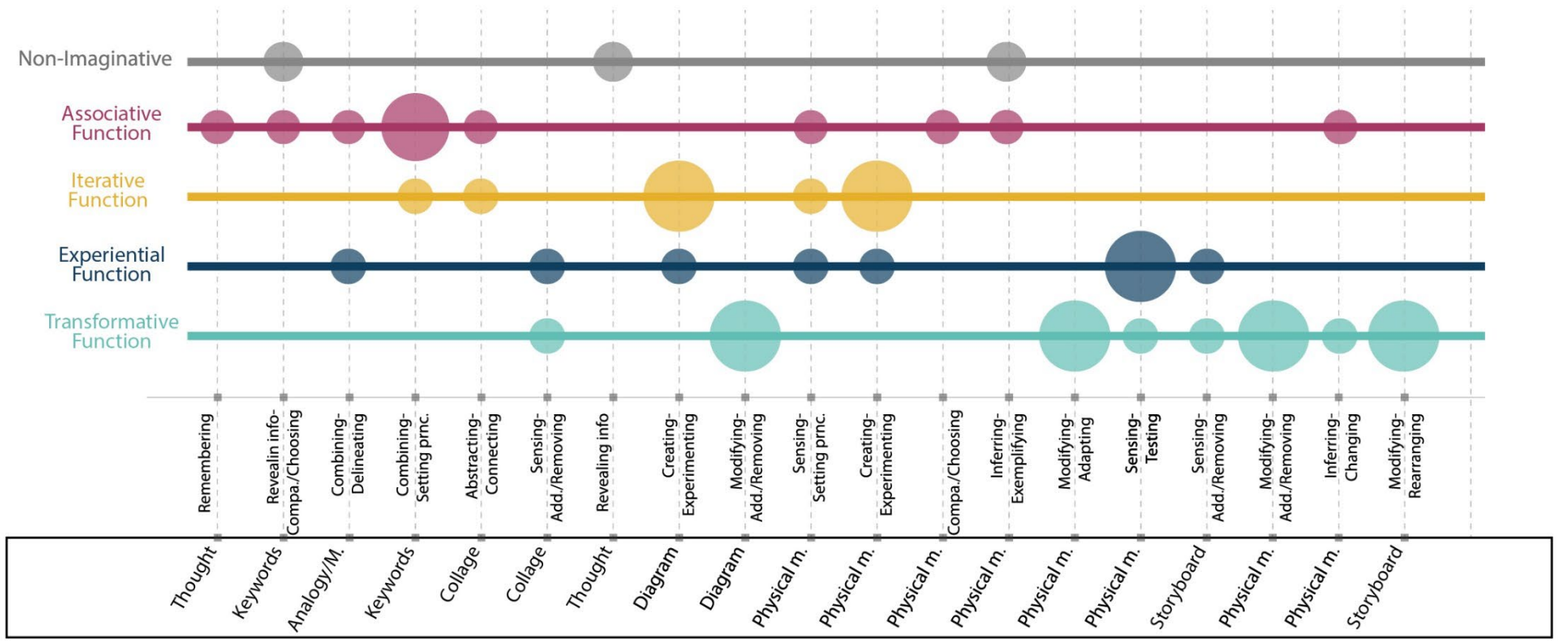
Figure C.3 : Imagination mapping of Imaginer-3.

no.2, no.5, no.6

IMAGINER-4

First grade, Male, Foreigner

Imagination chart in the design process



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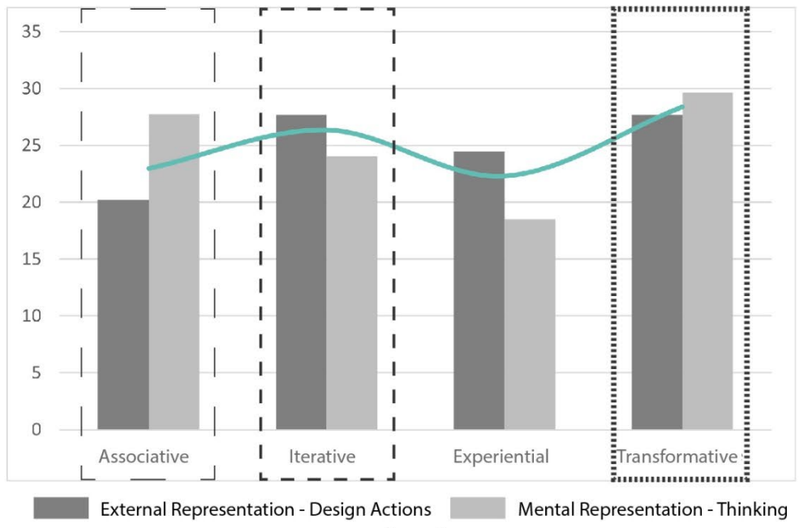


Percentage Graph of Imagination Functions

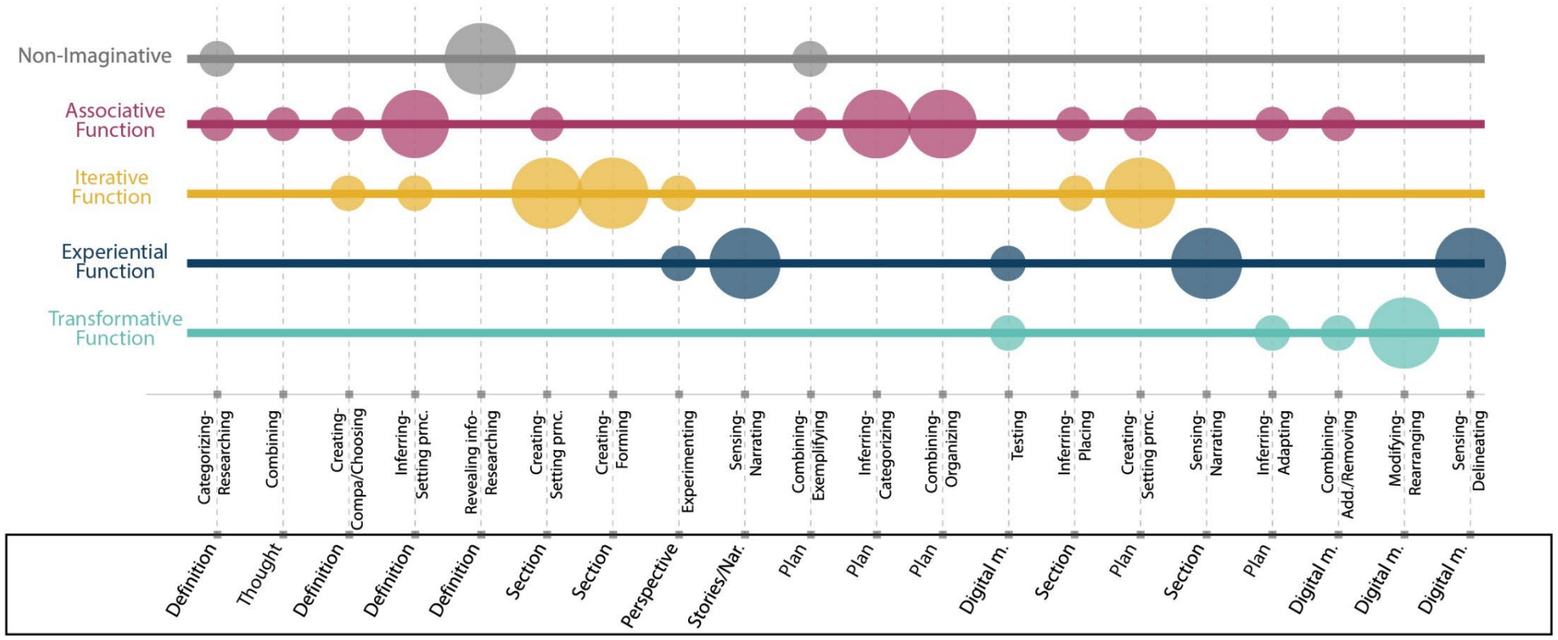
Figure C.4 : Imagination mapping of Imaginer-4.

no.2, no.4, no.6

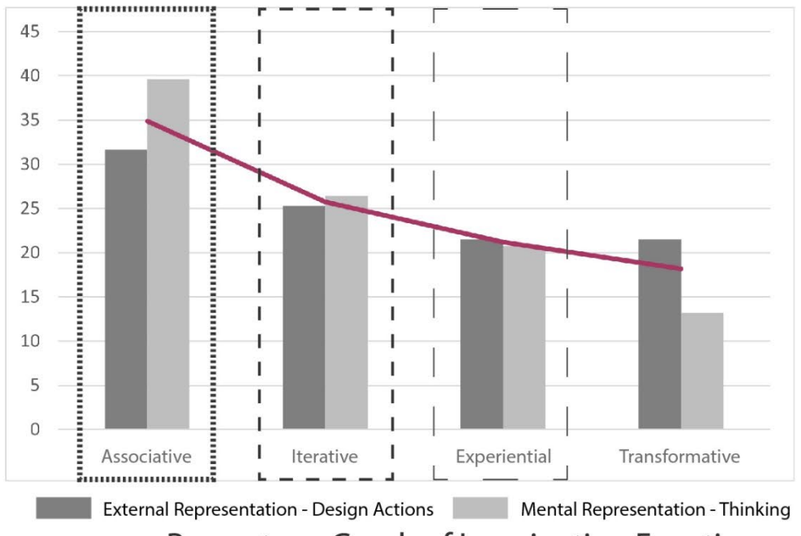
IMAGINER-5

Fourth grade, Female, Turkish

Imagination chart in the design process



Word Cloud



Percentage Graph of Imagination Functions

Figure C.5 : Imagination mapping of Imaginer-5.

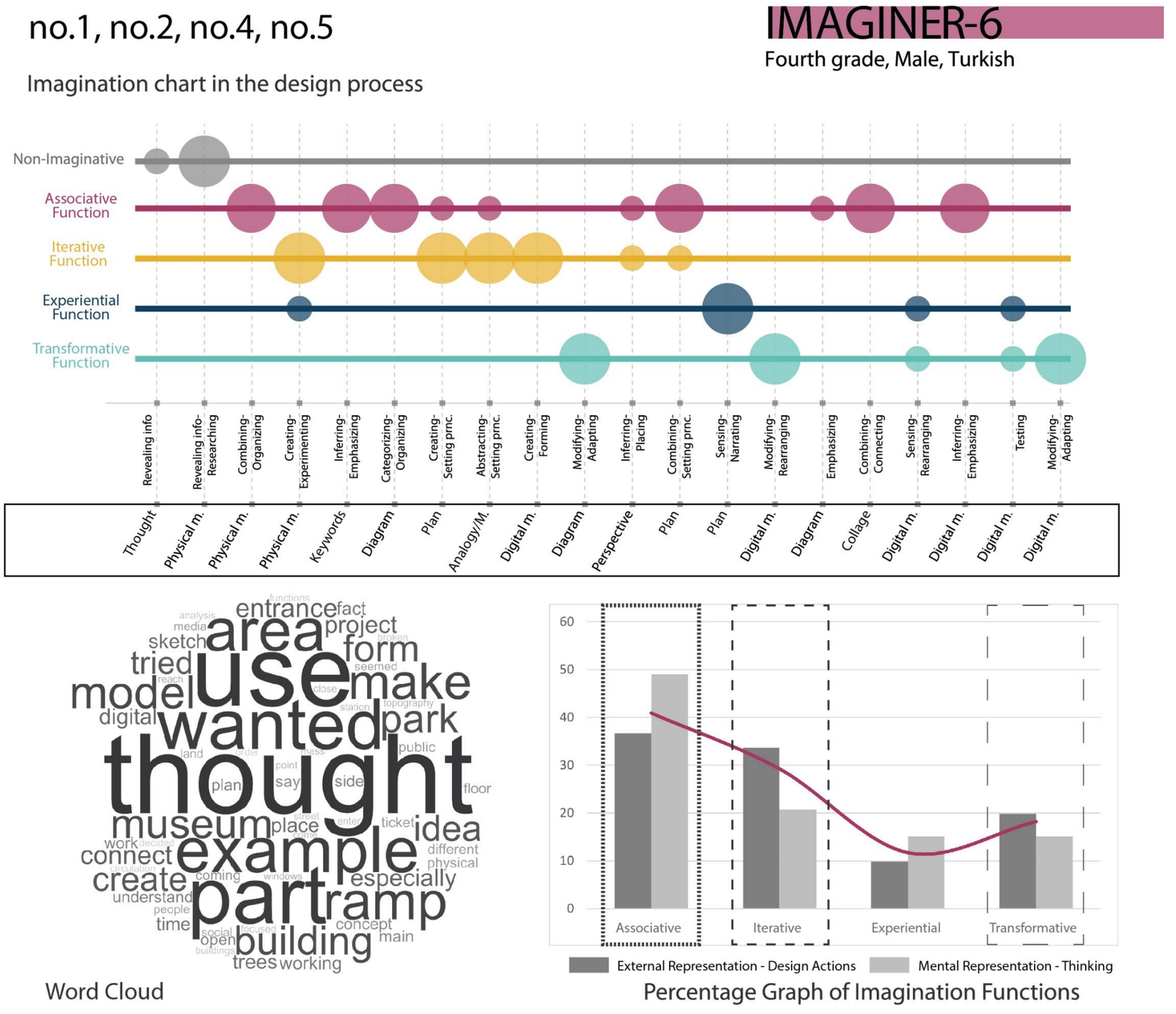


Figure C.6 : Imagination mapping of Imaginer-6.

no.4, no.5

IMAGINER-7

First grade, Female, Turkish

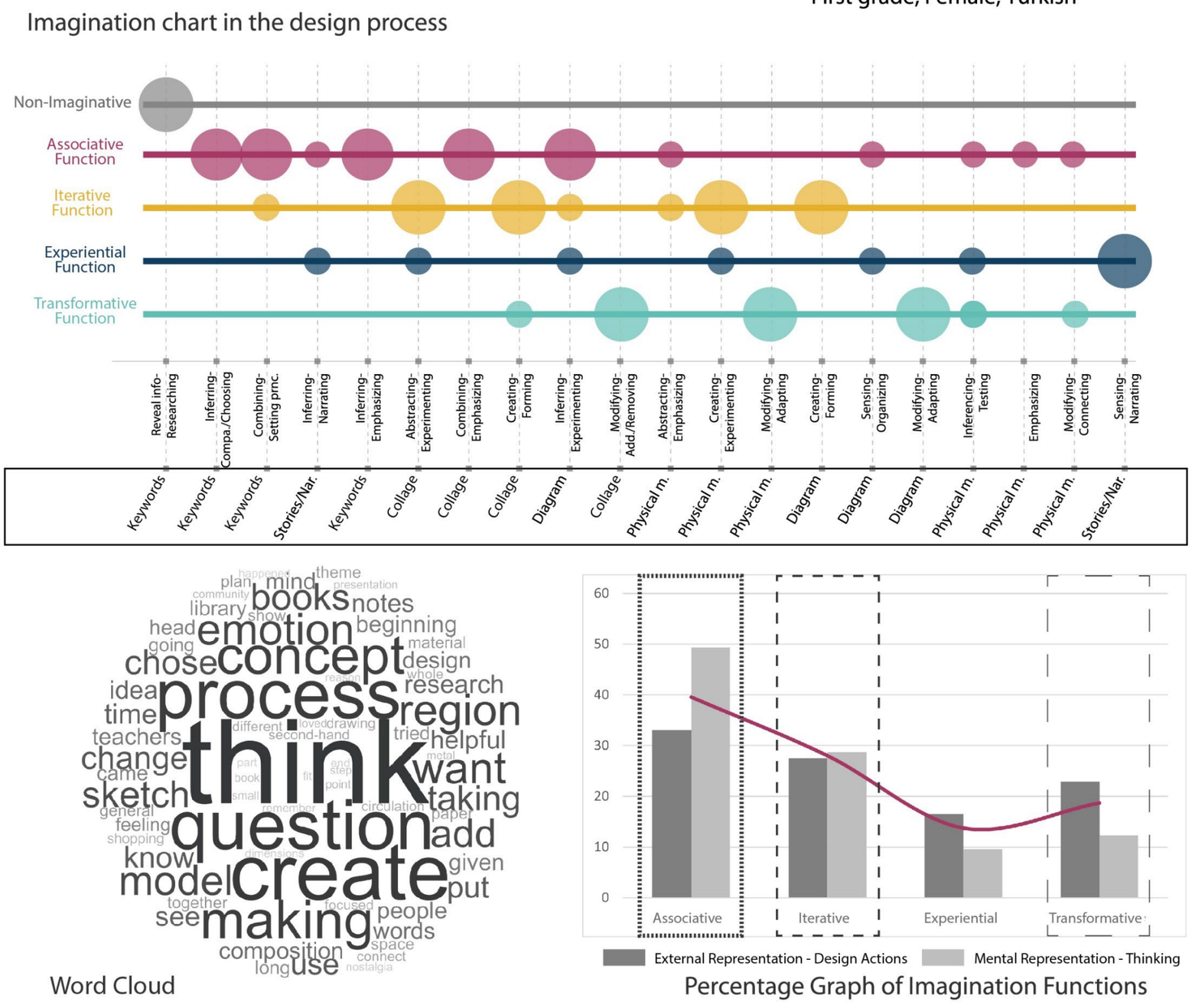


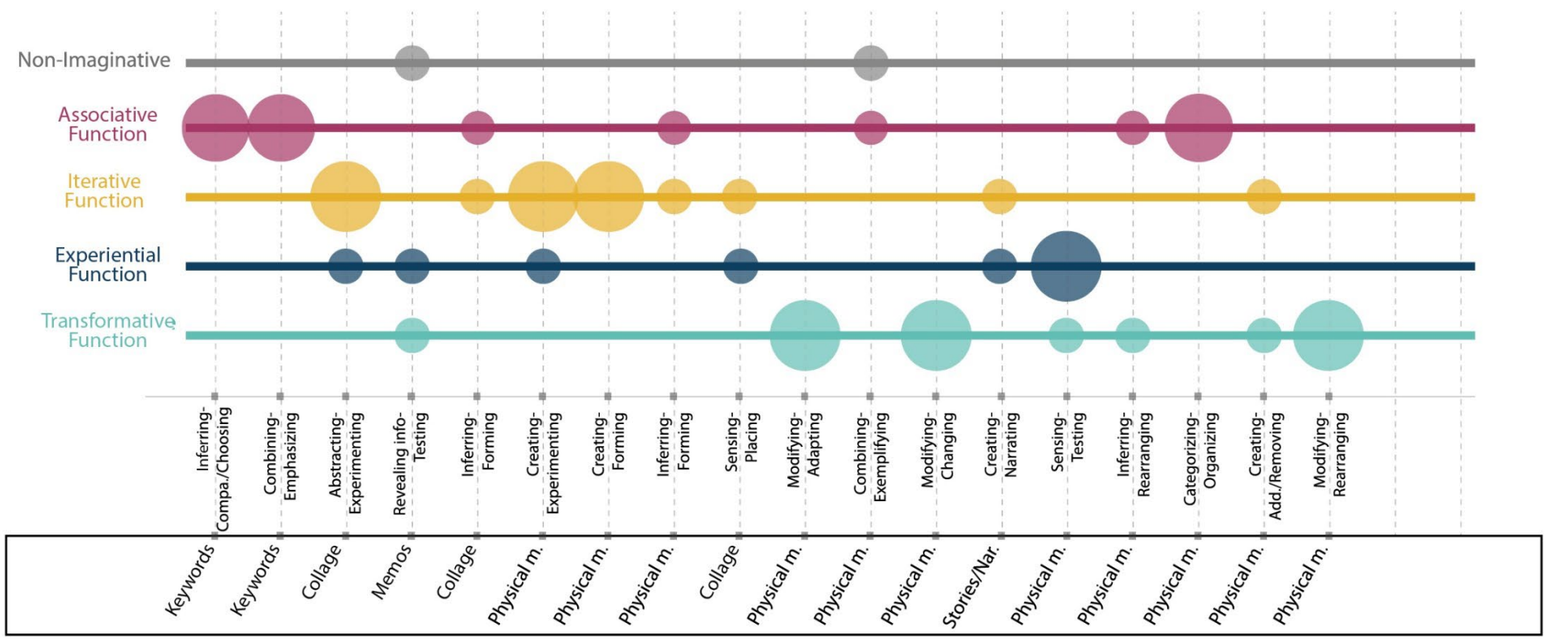
Figure C.7 : Imagination mapping of Imaginer-7.

no.5

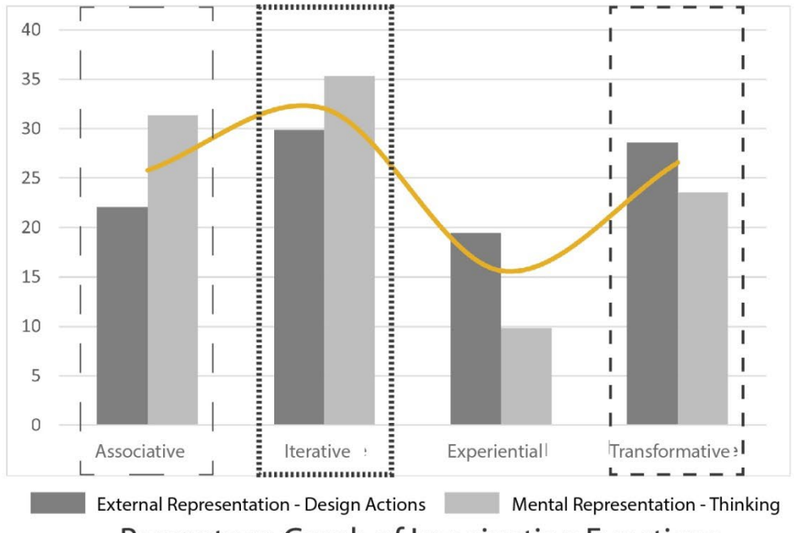
IMAGINER-8

First grade, Female, Turkish

Imagination chart in the design process



Word Cloud



Percentage Graph of Imagination Functions

Figure C.8 : Imagination mapping of Imaginer-8.

no.1, no.2, no.3, no.6

IMAGINER-9

First grade, Female, Turkish

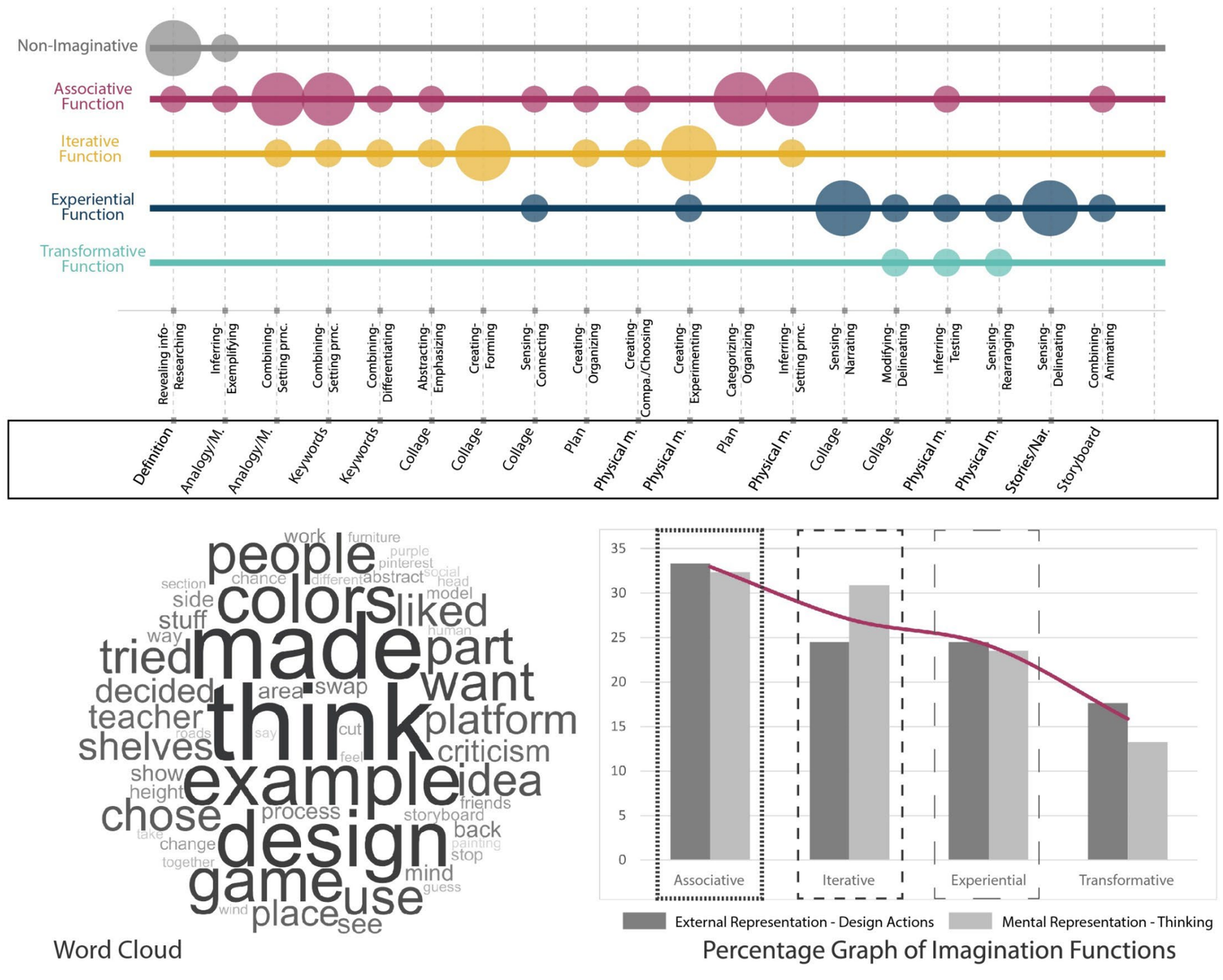


Figure C.9 : Imagination mapping of Imaginer-9.

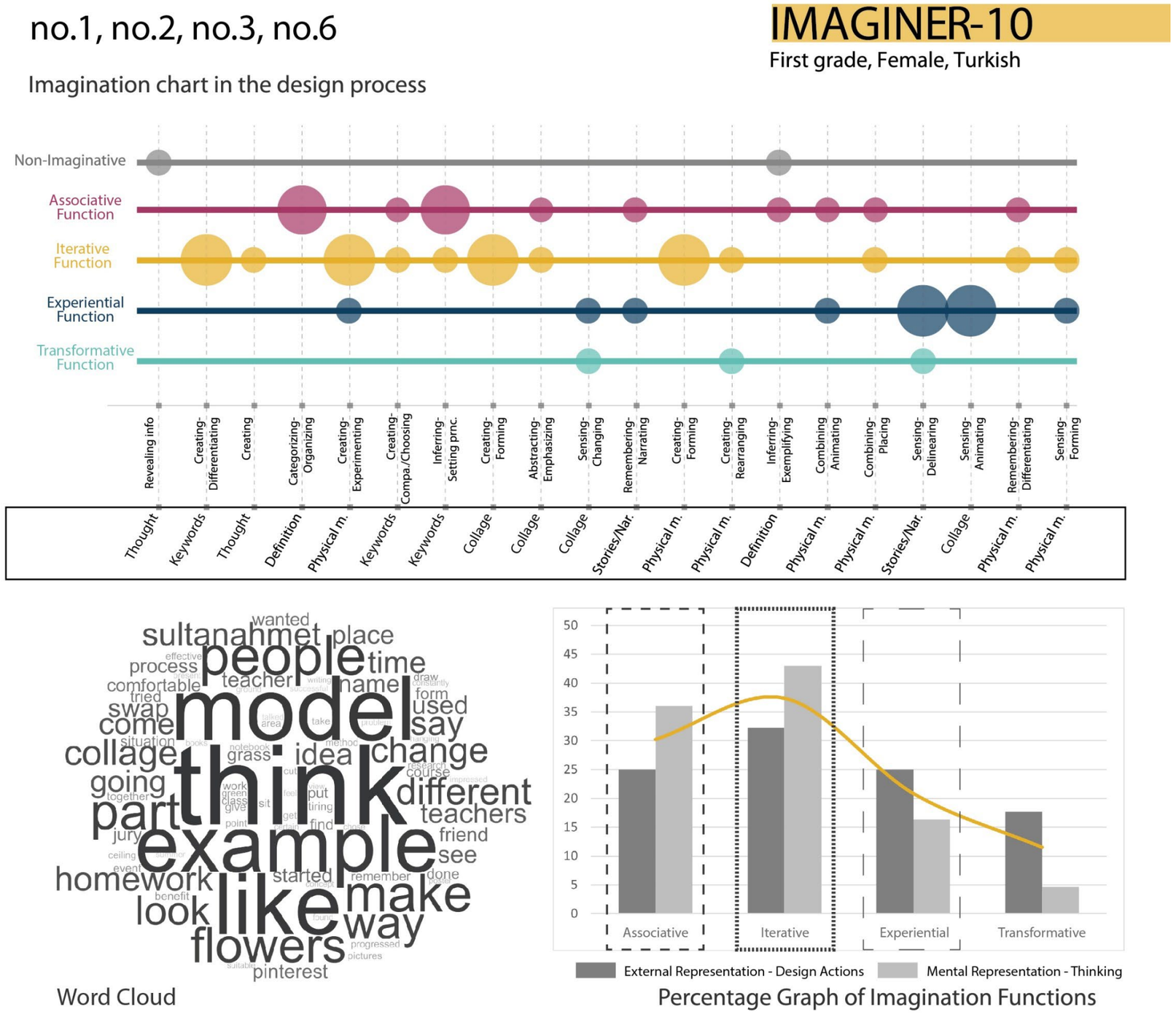
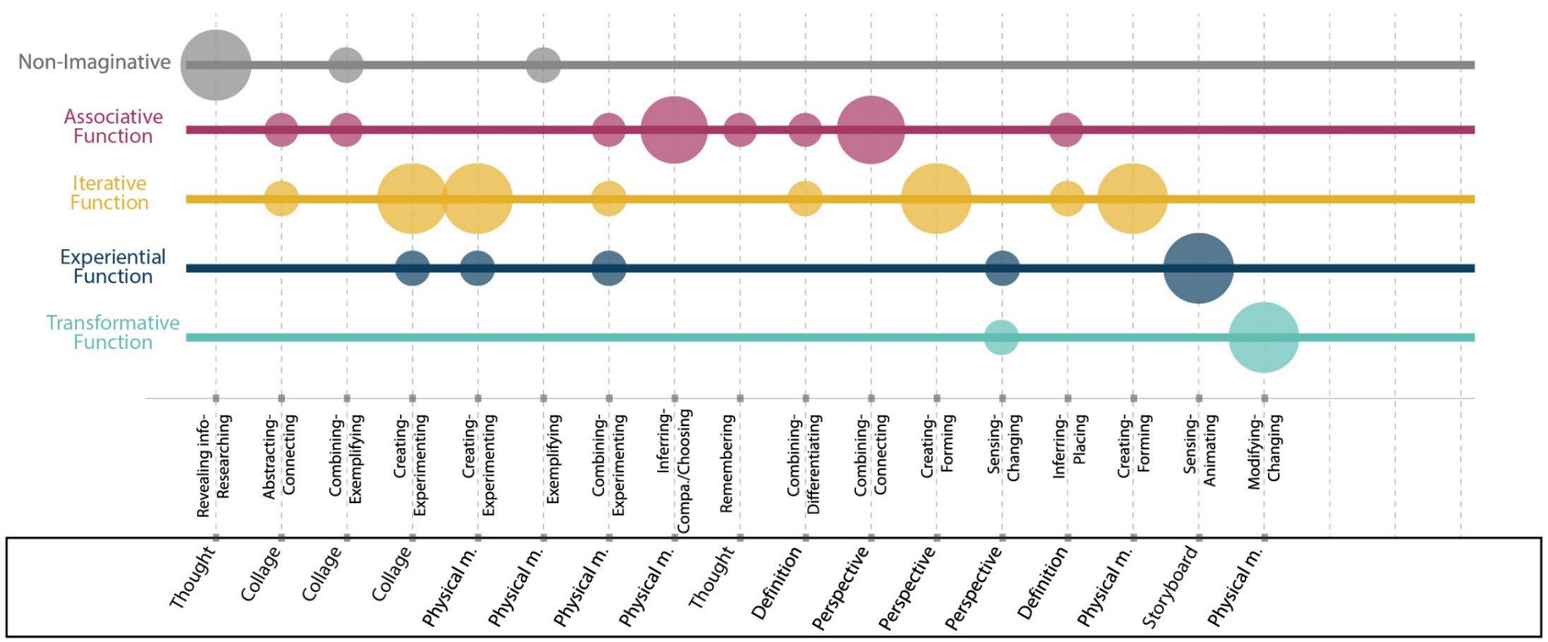


Figure C.10 : Imagination mapping of Imaginer-10.

no.2, no.3, no.6

IMAGINER-11

First grade, Female, Turkish



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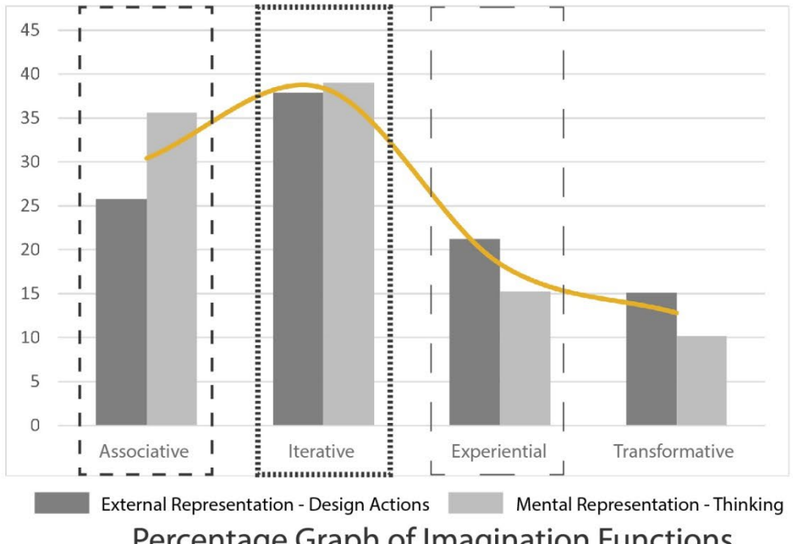


Percentage Graph of Imagination Functions

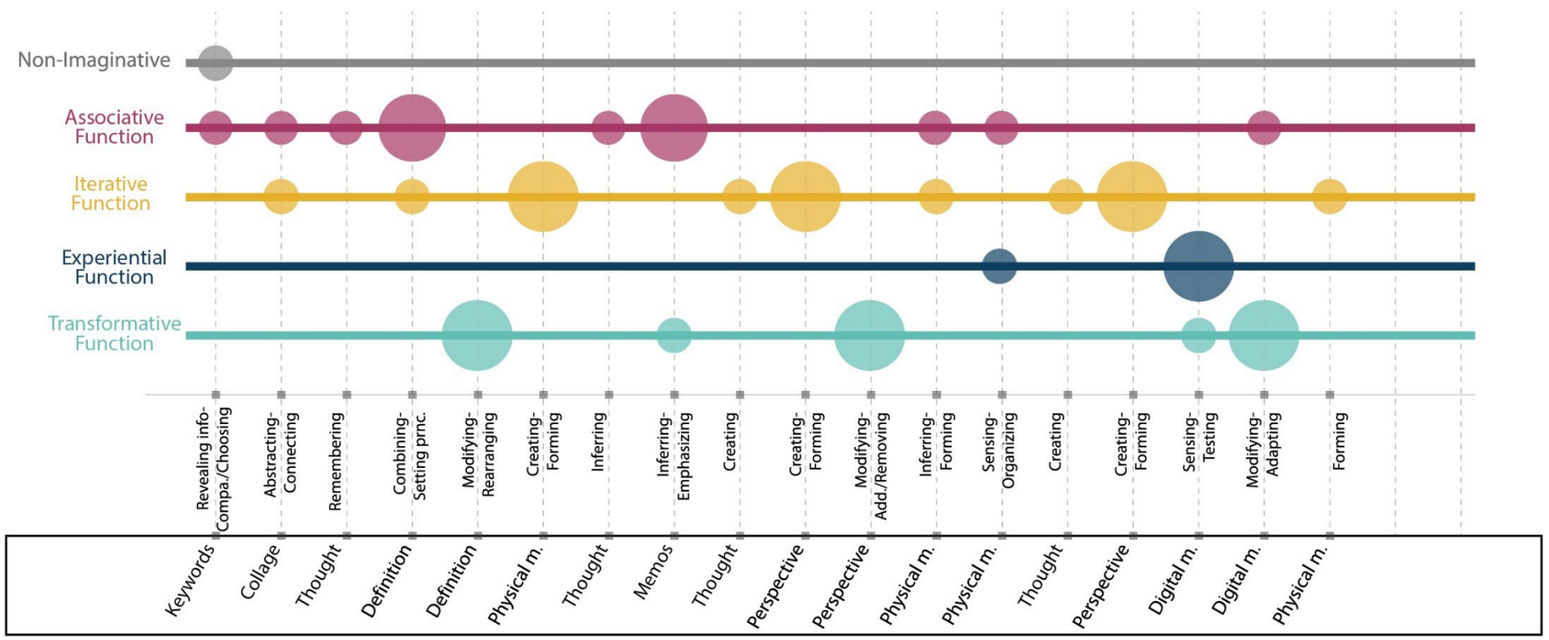
Figure C.11 : Imagination mapping of Imaginer-11.

no.3, no.4

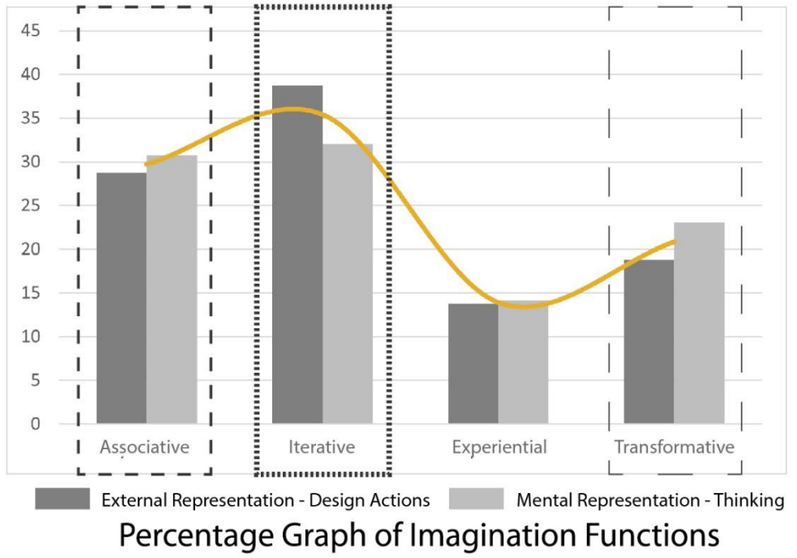
IMAGINER-12

First grade, Female, Turkish

Imagination chart in the design process



Word Cloud



Percentage Graph of Imagination Functions

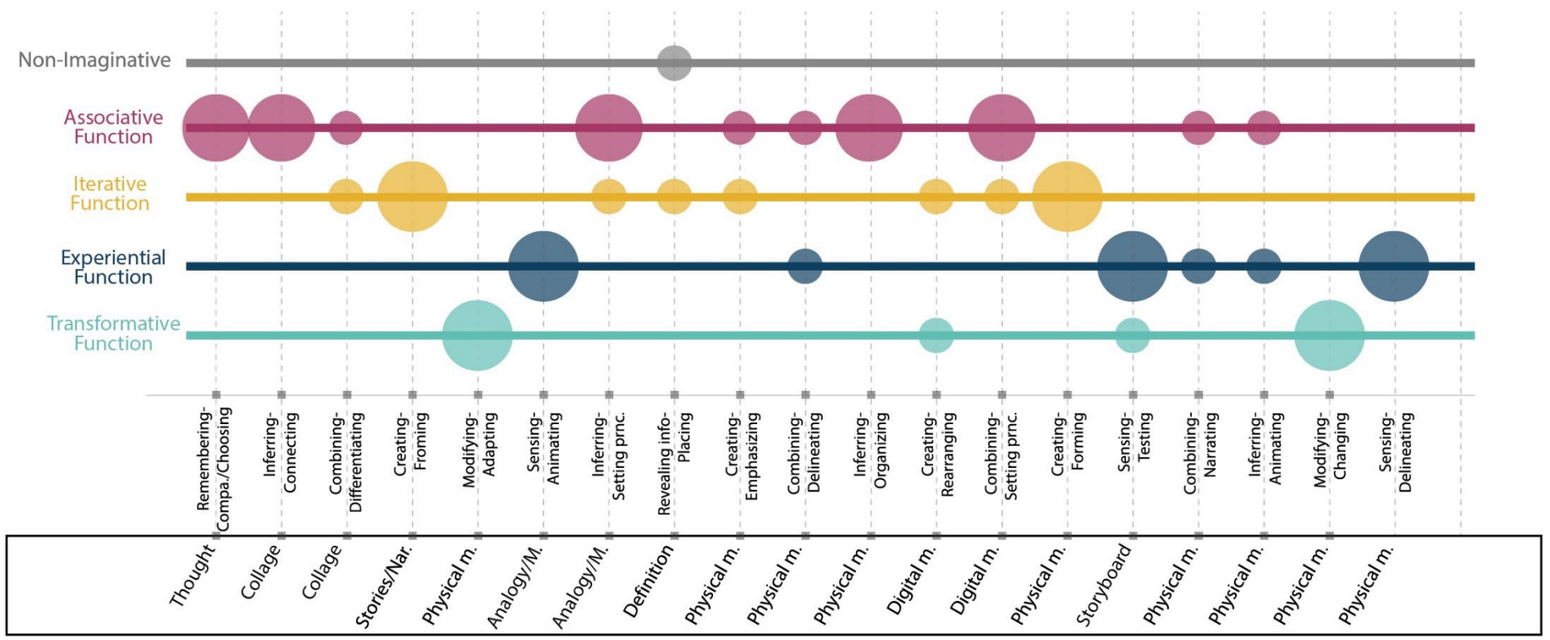
Figure C.12 : Imagination mapping of Imaginer-12.

no.1, no.2, no.4, no.5, no.6

IMAGINER-13

Fourth grade, Female, Turkish

Imagination chart in the design process



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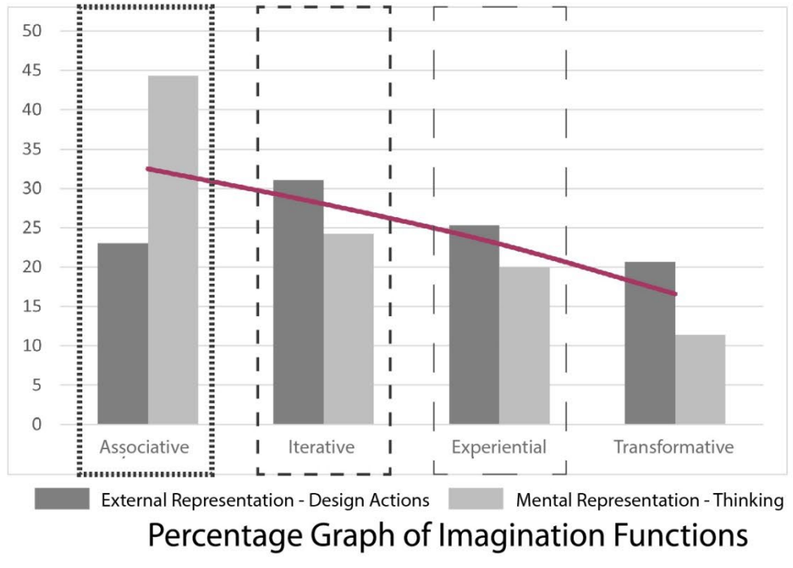


Percentage Graph of Imagination Functions

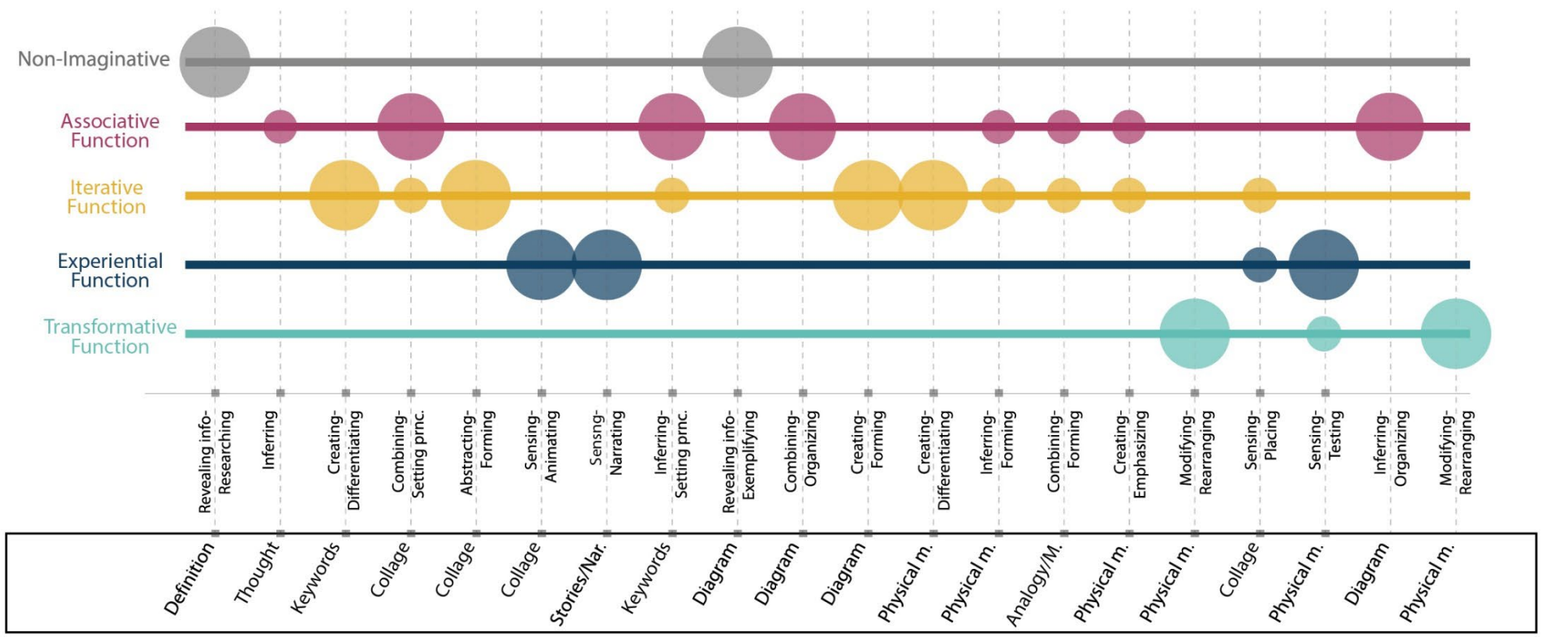
Figure C.13 : Imagination mapping of Imaginer-13.

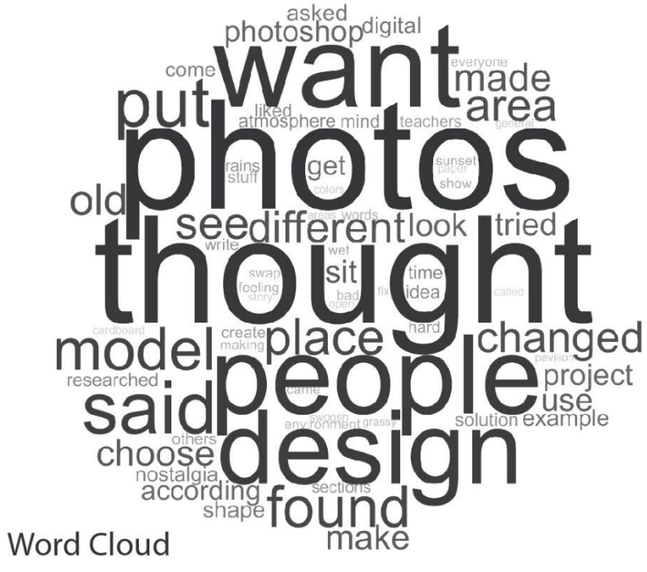
no.1, no.2, no.4, no.5, no.6

IMAGINER-14

First grade, Female, Foreigner

Imagination chart in the design process





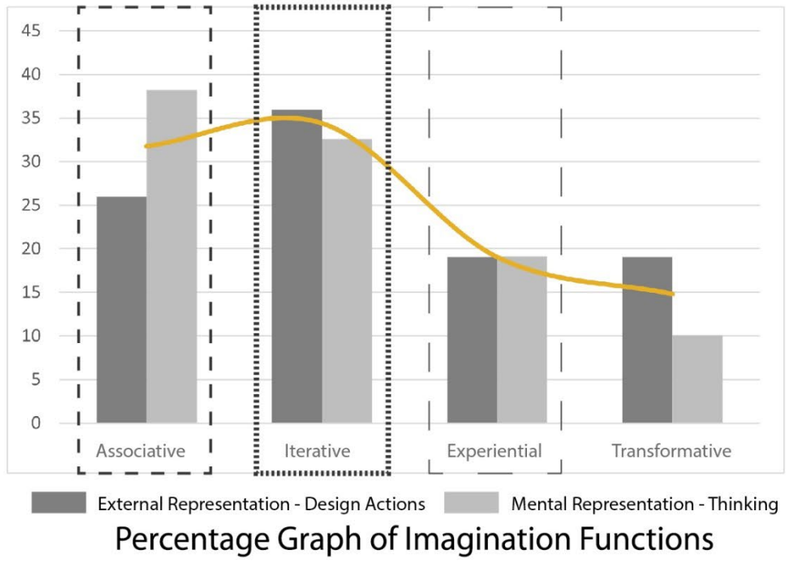


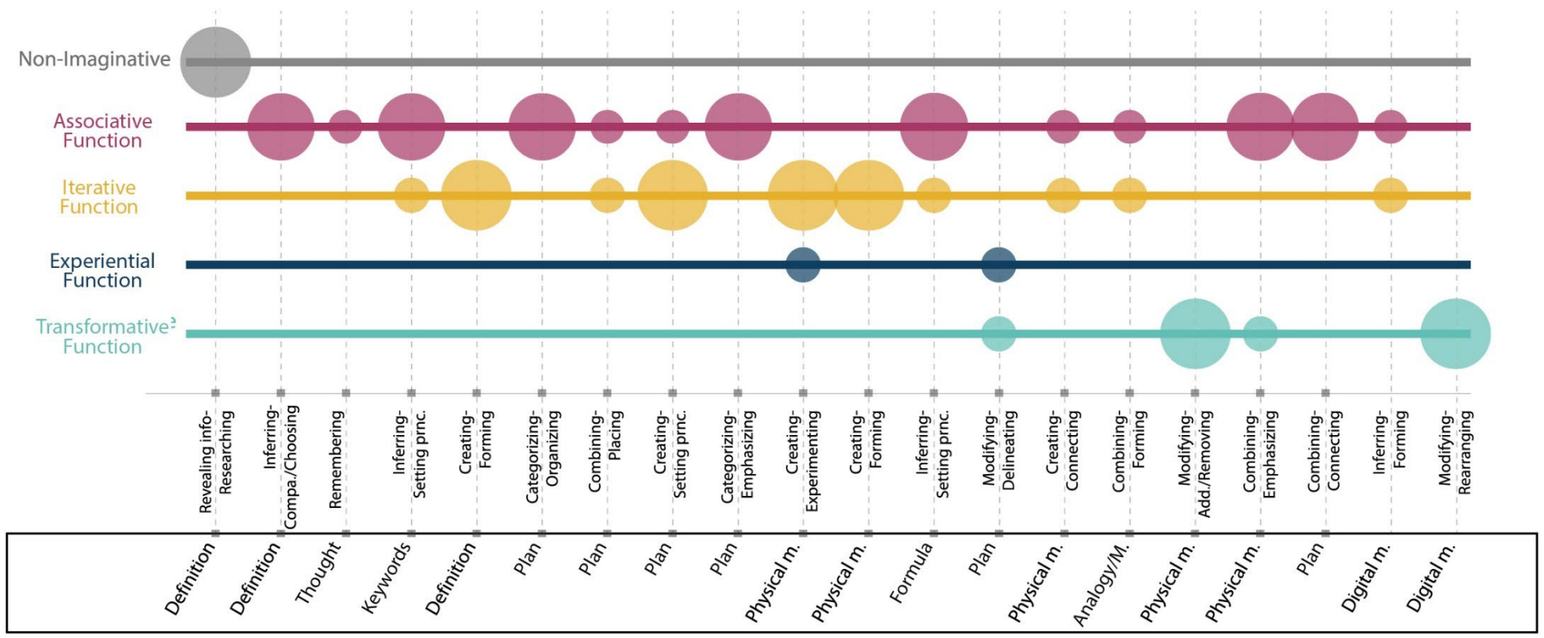
Figure C.14 : Imagination mapping of Imaginer-14.

no.1, no.3, no.4

IMAGINER-15

Fourth grade, Male, Turkish

Imagination chart in the design process



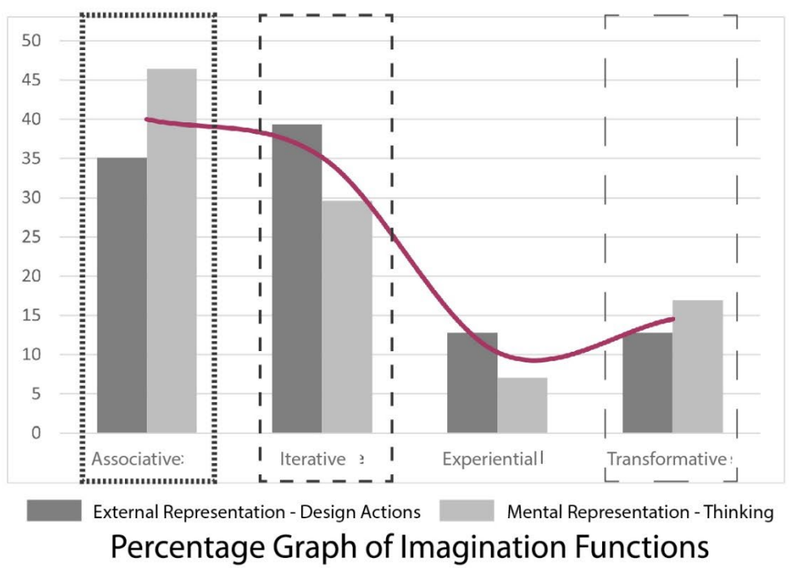
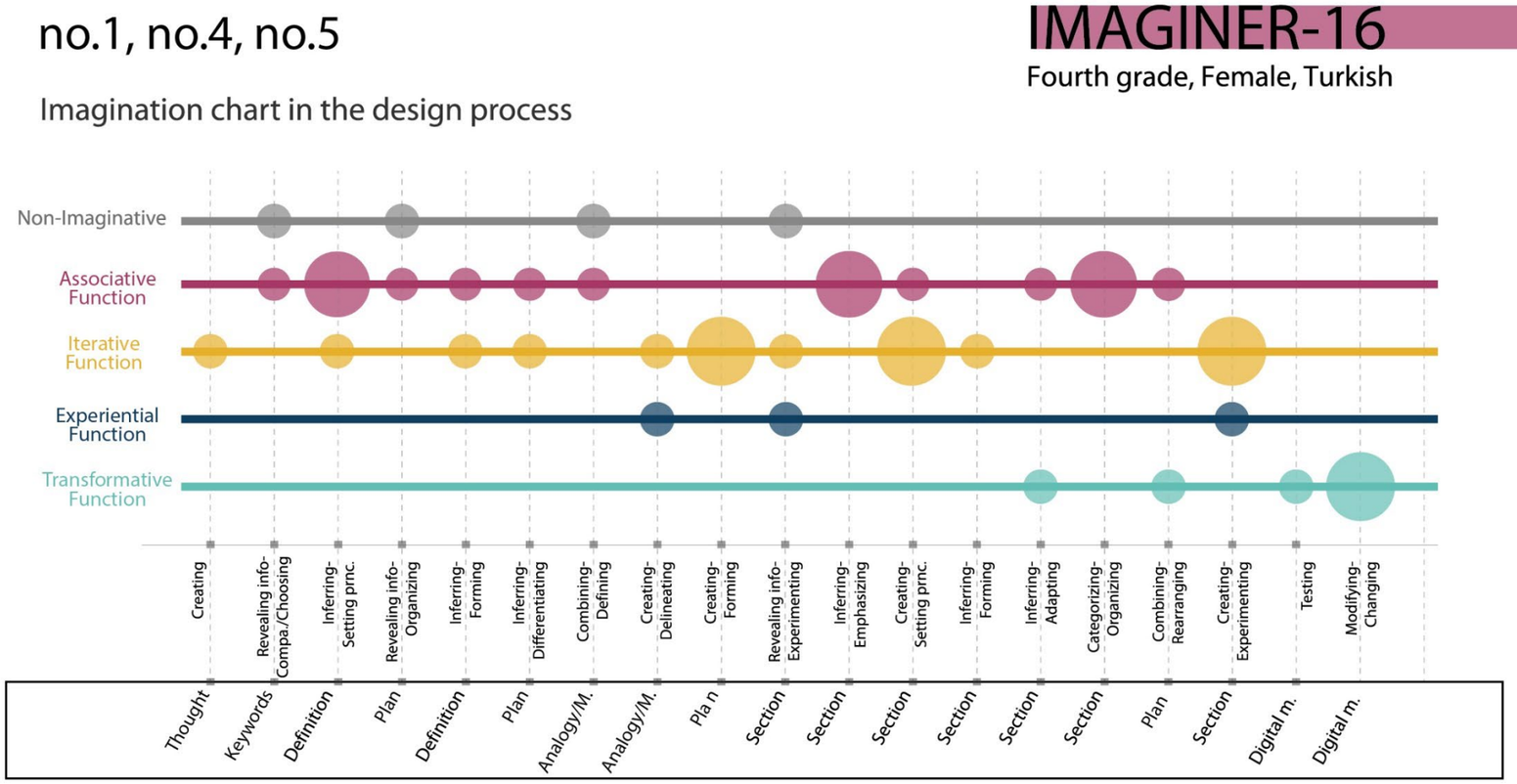


Figure C.15 : Imagination mapping of Imaginer-15.

no.1, no.4, no.5

IMAGINER-16

Fourth grade, Female, Turkish



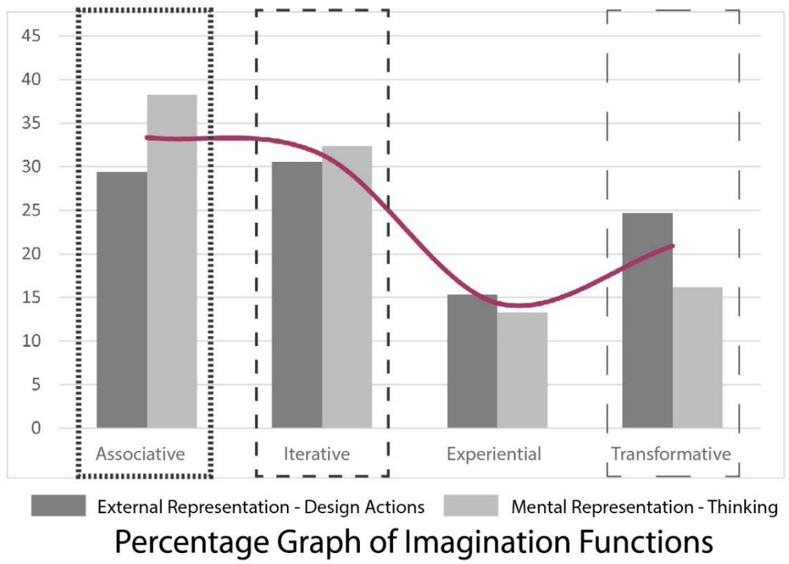


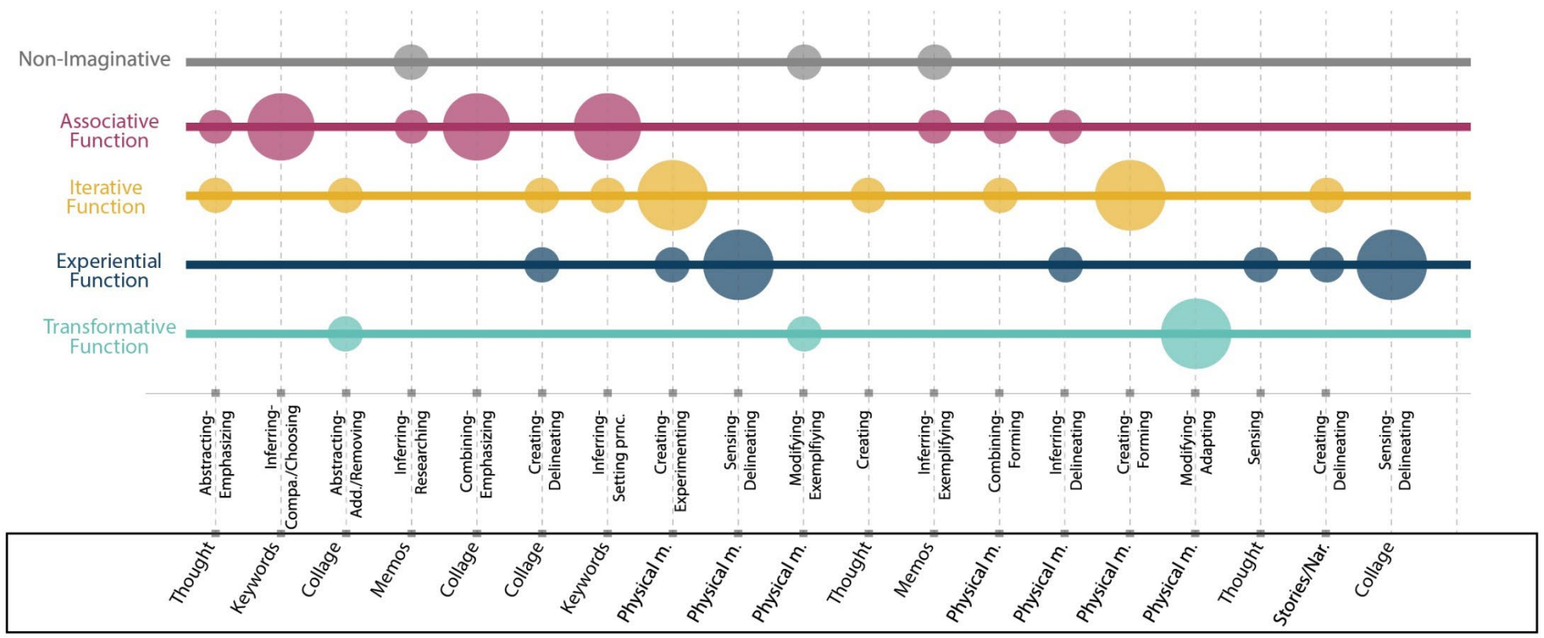
Figure C.16 : Imagination mapping of Imaginer-16.

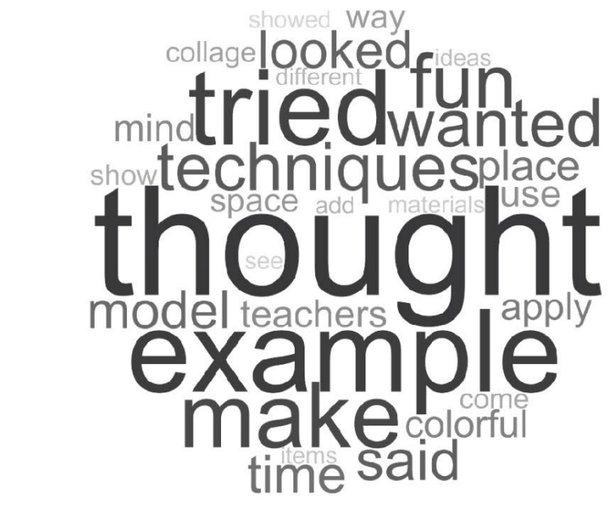
no.2, no.3, no.4, no.6

IMAGINER-17

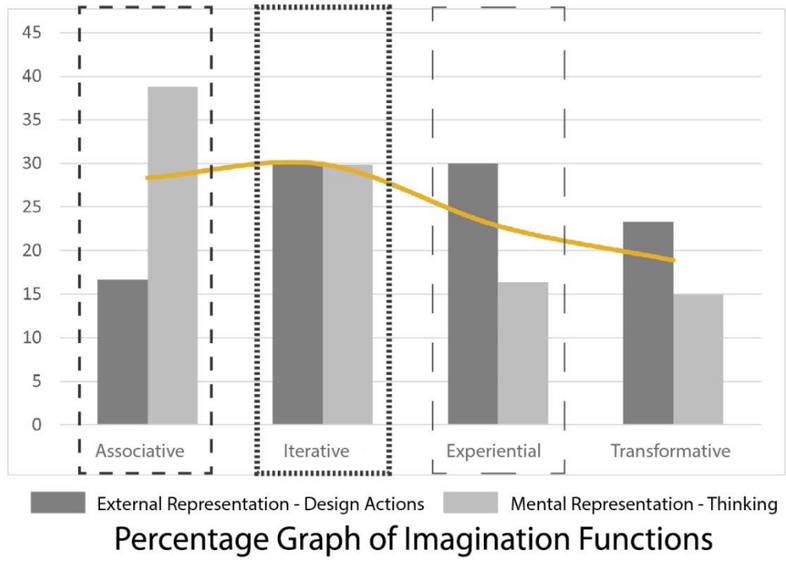
First grade, Female, Turkish

Imagination chart in the design process





Word Cloud



Percentage Graph of Imagination Functions

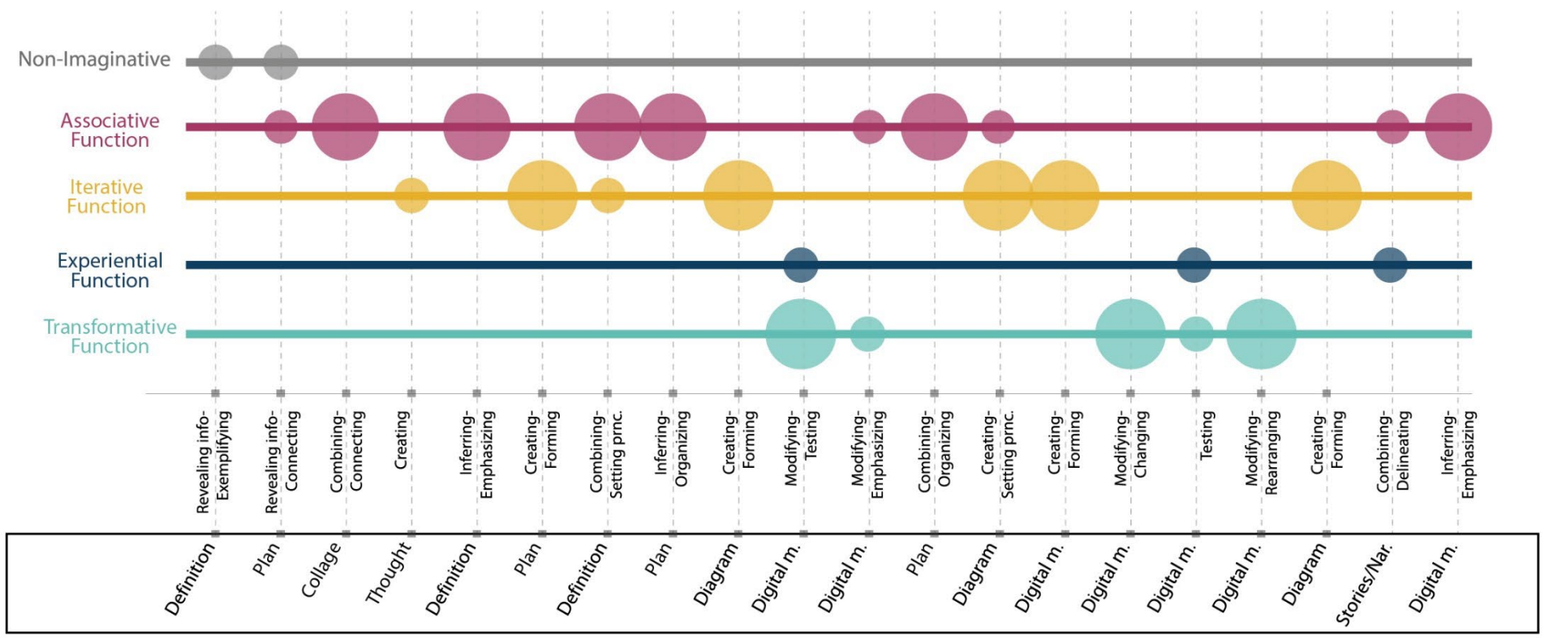
Figure C.17 : Imagination mapping of Imaginer-17.

no.5

IMAGINER-18

Fourth grade, Male, Turkish

Imagination chart in the design process



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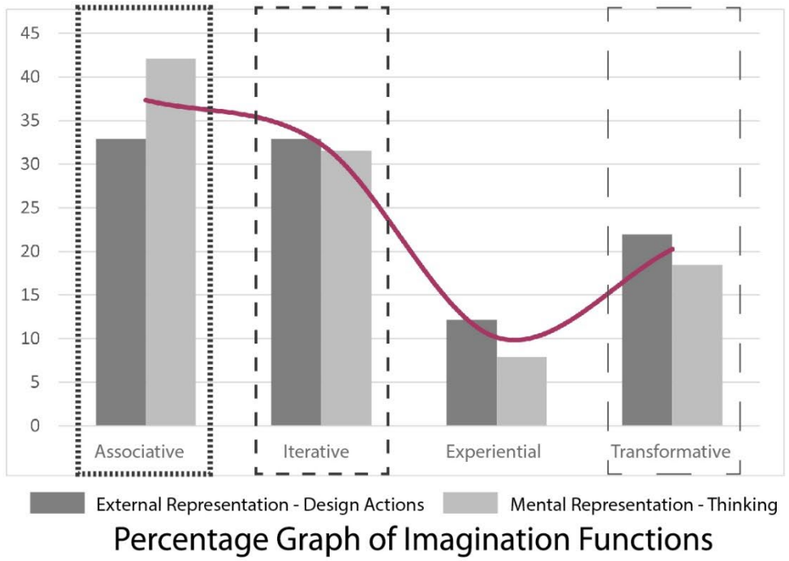


Percentage Graph of Imagination Functions

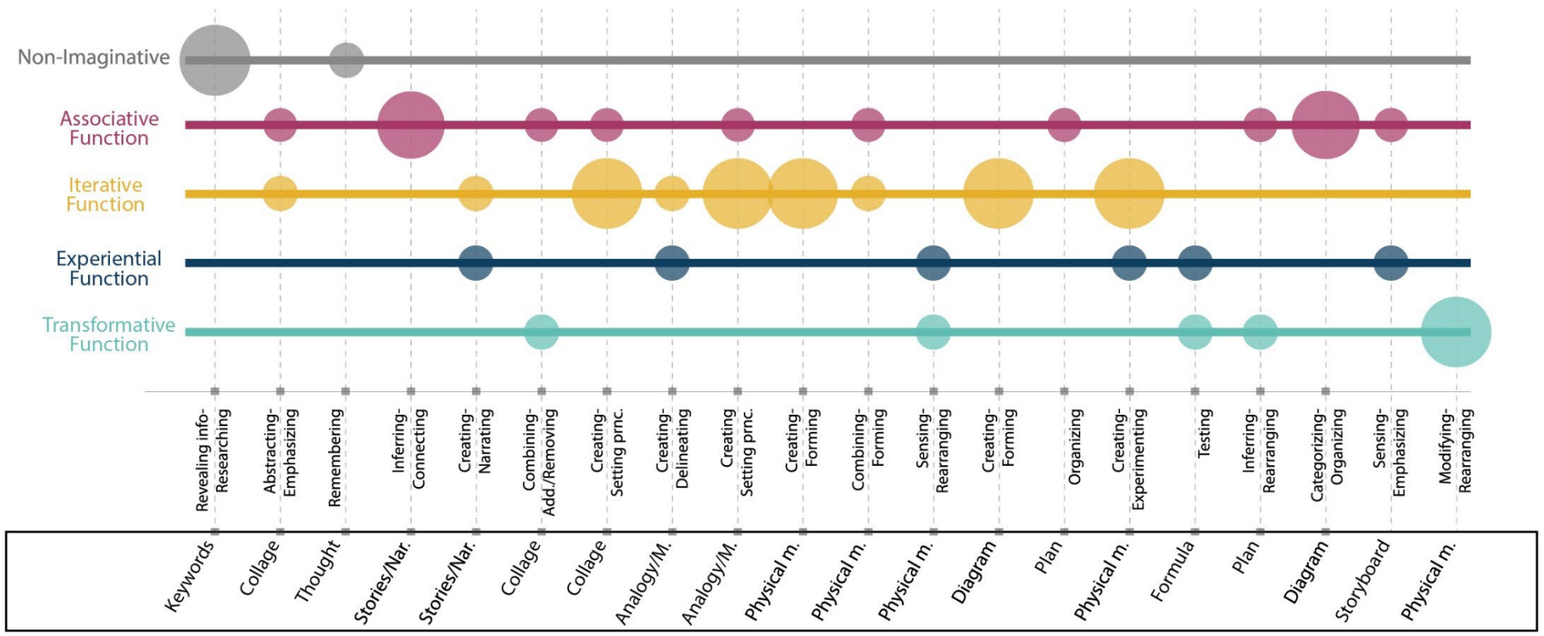
Figure C.18 : Imagination mapping of Imaginer-18.

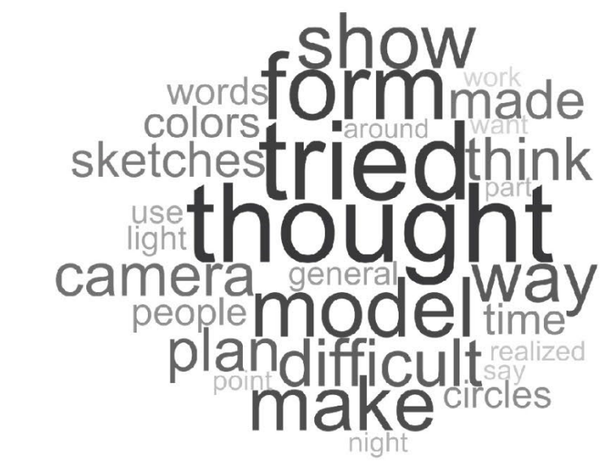
no.1, no.3, no.4

IMAGINER-19

First grade, Female, Turkish

Imagination chart in the design process





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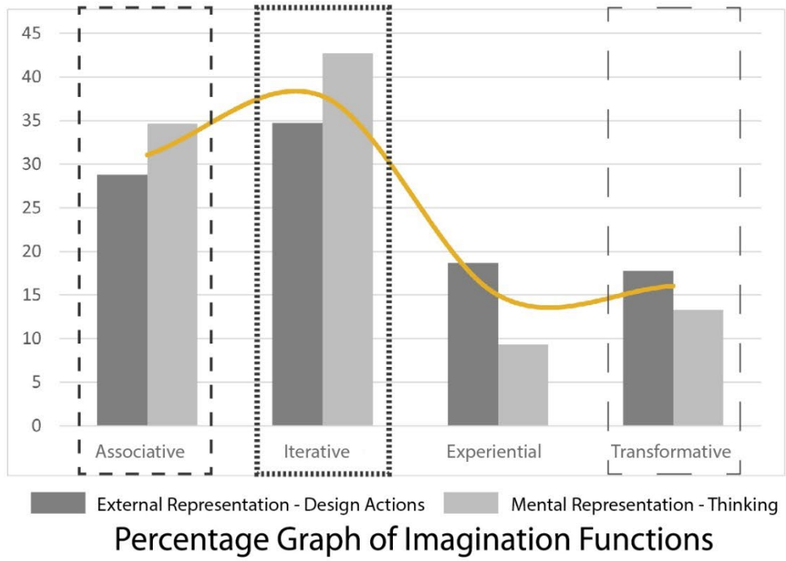


Percentage Graph of Imagination Functions

Figure C.19 : Imagination mapping of Imaginer-19.

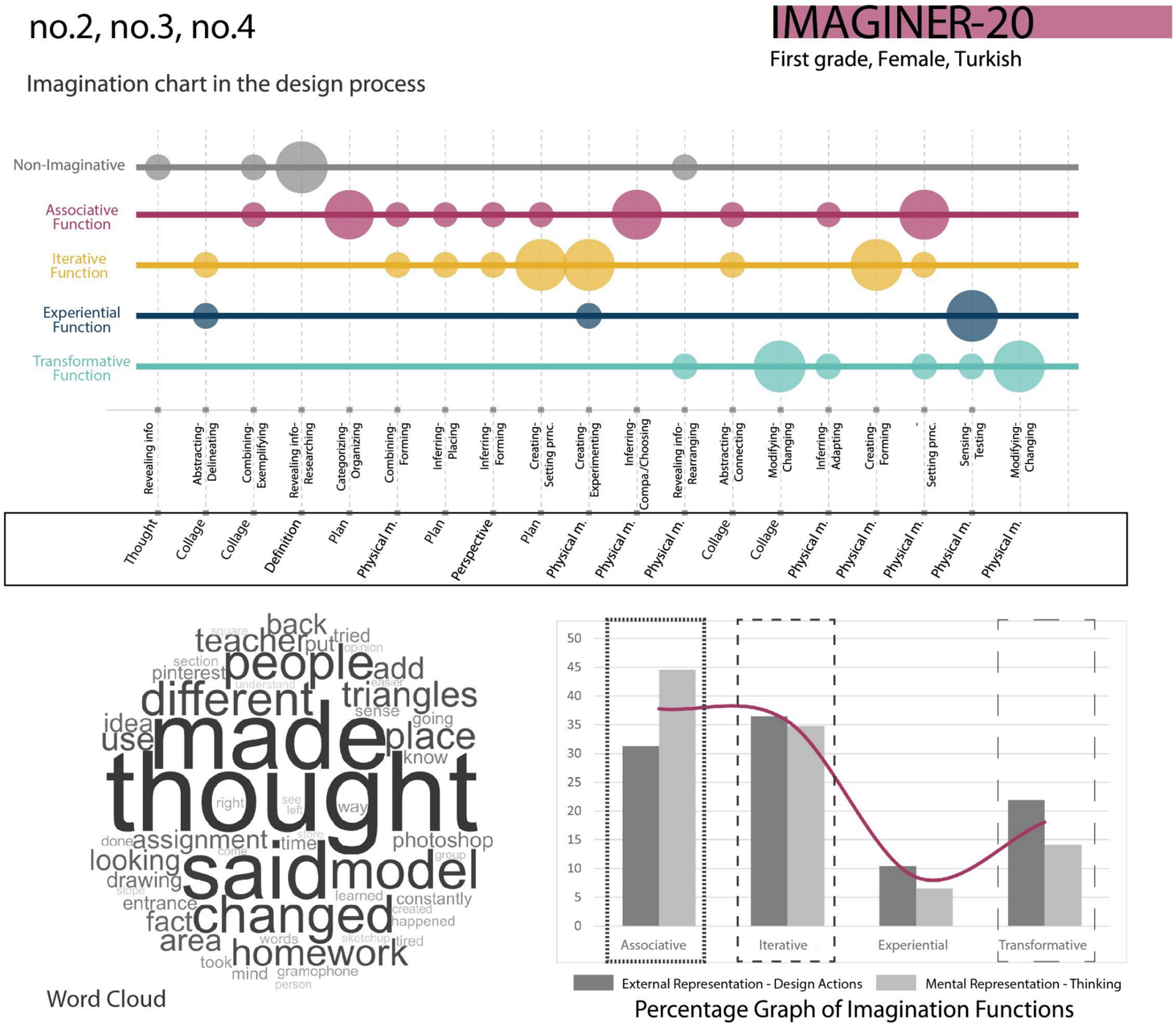


Figure C.20 : Imagination mapping of Imaginer-20.

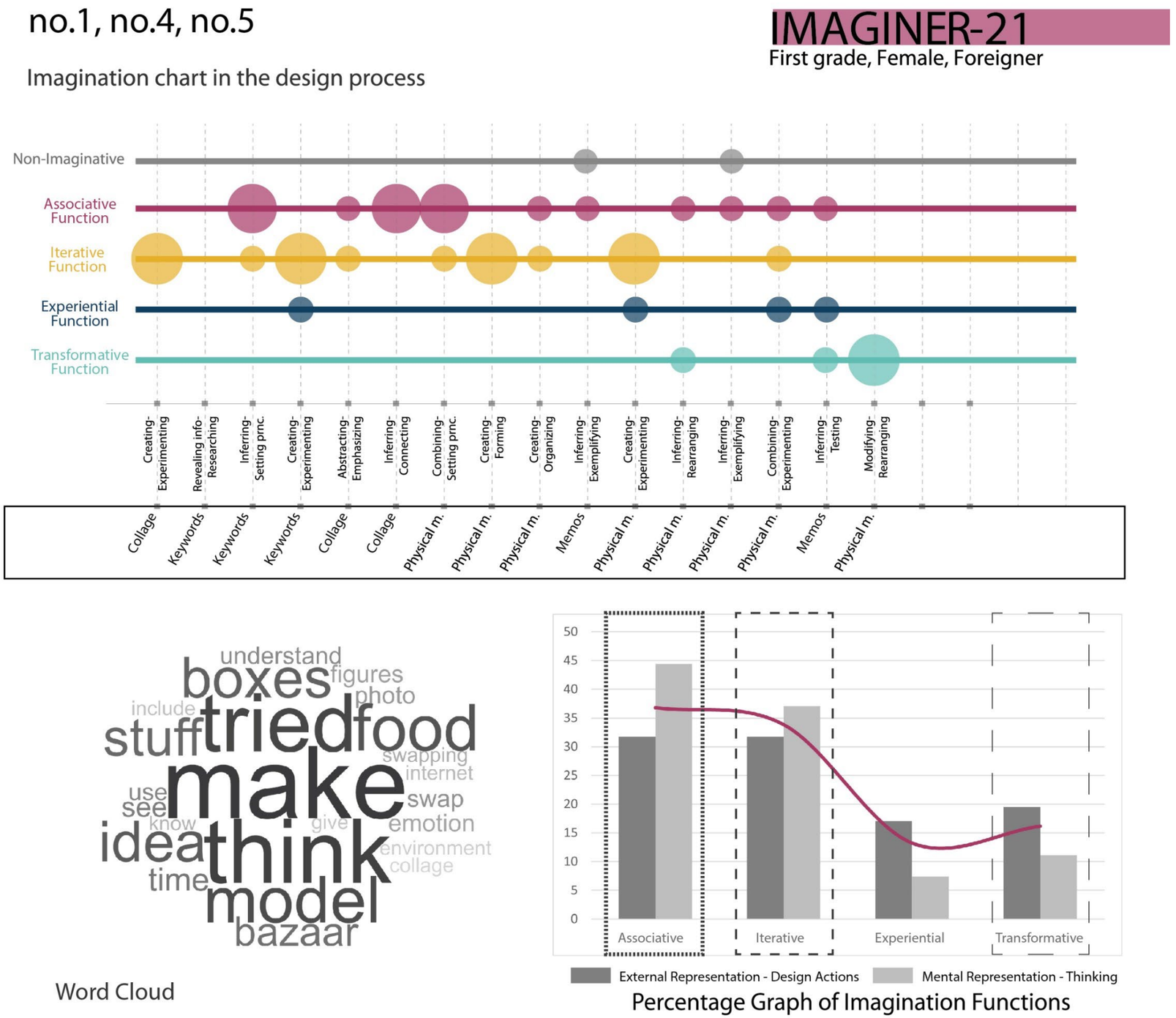


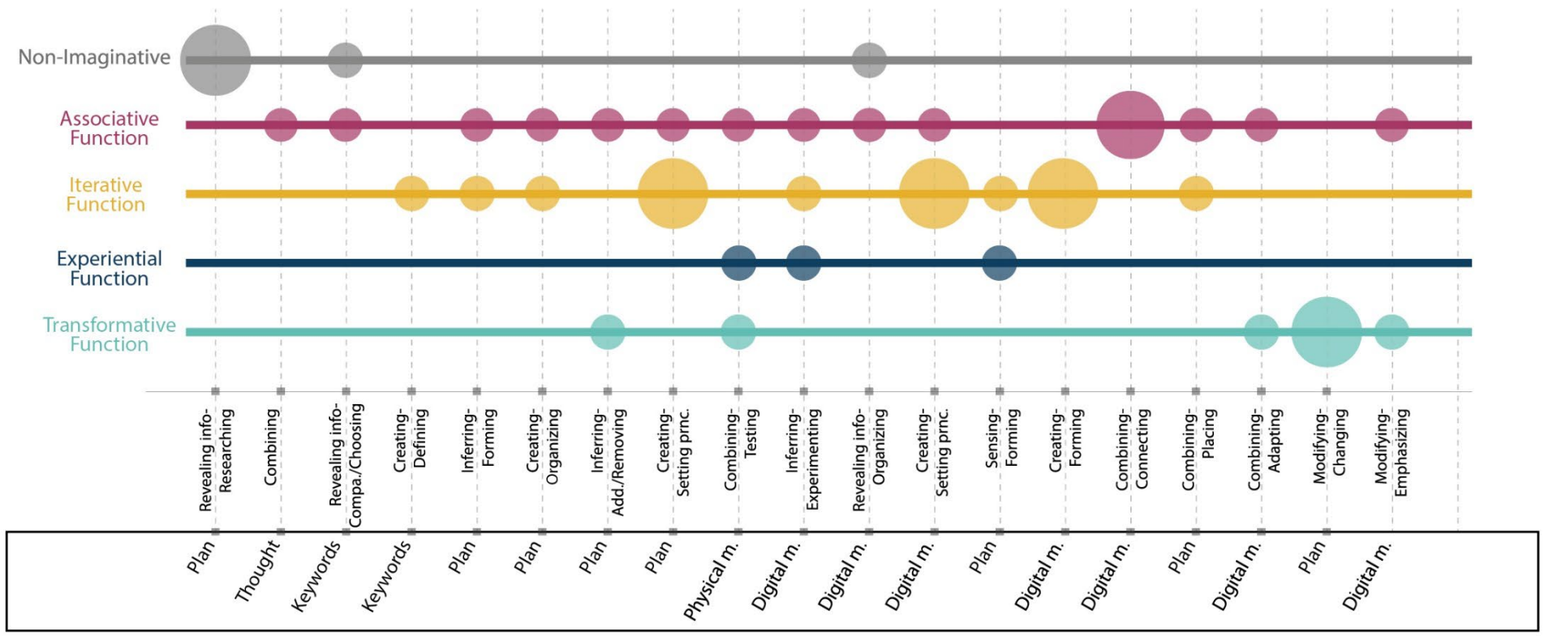
Figure C.21 : Imagination mapping of Imaginer-21.

no.4, no.5

IMAGINER-22

Fourth grade, Female, Turkish

Imagination chart in the design process



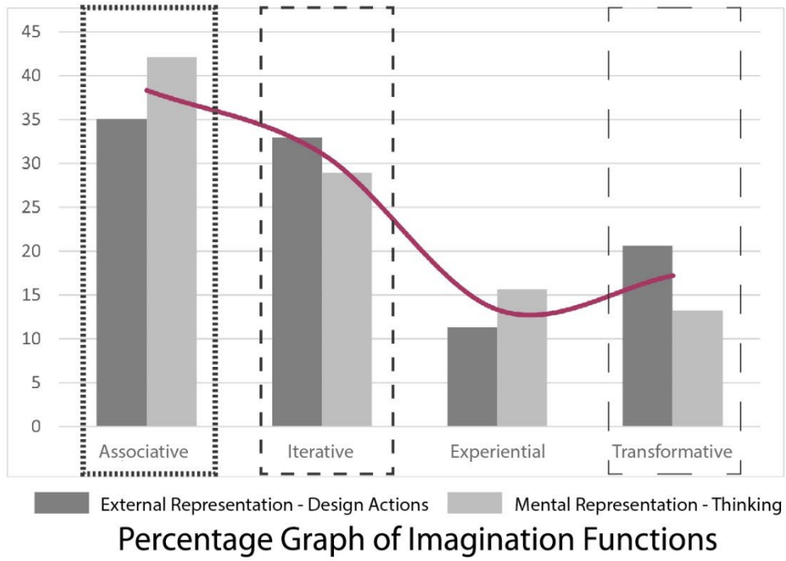
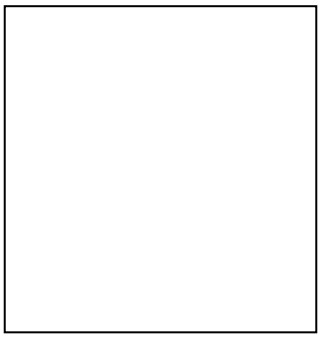


Figure C.22 : Imagination mapping of Imaginer-22.

CURRICULUM VITAE



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OTHER PUBLICATIONS, PRESENTATIONS AND PATENTS:

- **Uğurli, A. B. & Adigüzel, A. E.** (2022) Neoliberal Konut Politikalarının Rezidans Katalogları Üzerinden Okunması: Kartal Örneği.7. Uluslararası Kent Araştırmaları Kongresi, 16-17-18 Mayıs 2022, Ankara.
- **Uğurli, A. B. & Adıgüzel, A. E.** (2021). "Asri Han", DOCOMOMO Türkiye – Türkiye Mimarlığında Modernizmin Yerel Açılımları XVII 2021 Çevrimiçi, Türkiye, 12-13 Kasım 2021, s.73.
- **Adıgüzel, A. E. & Kiştin, S. A.** (2021). "Antalya Yetiştirme Yurdu", DOCOMOMO Türkiye – Türkiye Mimarlığında Modernizmin Yerel Açılımları XVII 2021 Çevrimiçi, Türkiye, 12-13 Kasım 2021, s.87