



**A COMPARATIVE STUDY OF AUTOMOTIVE /
TRANSPORTATION DESIGN PROGRAMS &
UNIVERSITY - INDUSTRY COOPERATION MODELS
IN HIGHER EDUCATION**

EFE UKUR

Thesis for the Master's Program in Design Studies

Graduate School
Izmir University of Economics

Izmir

2023

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TRANSPORTATION DESIGN PROGRAMS &
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EFE ÇUKUR

THESIS ADVISOR: ASST. PROF. DR. CAN ÖZCAN

A Master's Thesis
Submitted to
the Graduate School of Izmir University of Economics
the Department of Design Studies

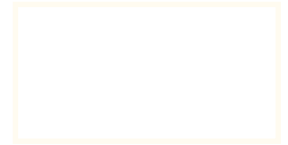
Izmir
2023

ETHICAL DECLARATION

I hereby declare that I am the sole author of this thesis and that I have conducted my work in accordance with academic rules and ethical behaviour at every stage from the planning of the thesis to its defence. I confirm that I have cited all ideas, information and findings that are not specific to my study, as required by the code of ethical behaviour, and that all statements not cited are my own.

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ABSTRACT

A COMPARATIVE STUDY OF AUTOMOTIVE / TRANSPORTATION DESIGN PROGRAMS & UNIVERSITY - INDUSTRY COOPERATION MODELS IN HIGHER EDUCATION

ÇUKUR, Efe

Master's Program in Design Studies

Advisor: Asst. Prof. Dr. Can ÖZCAN

August, 2023

This study aims to discuss and compare i) widespread and generic design, particularly industrial design education in relation to the specific needs of the automotive/transportation industry, and ii) an automotive/transportation design education model within and under to provide the conditions of design education and automotive industry, especially in Turkey and North Cyprus. The automotive industry is the 11th largest in the world (\$1.51 trillion). The automotive industry is known as the locomotive industry, but there is a non-automotive design department on the academic side of Turkey. This thesis: includes the presentation of a program proposal that meets the needs of the industry for Turkey and North Cyprus, the second largest automobile manufacturing country in Europe. On the higher graduate education, the automotive design departments get their subgroups like exterior design, clay modelling, UI Design, mobilite and interior design. Transportation design, a subfield of industrial design, is offered as higher education in transportation design

departments, particularly in America and Europe. In these departments, the curriculum is shaped to the needs of the sectors. The content of the study is an in-depth comparison of these institutions and how the requirements and demands of the industry are met in this regard and revealed. To be analysed under the headings of human resources, curriculum, university-industry cooperation, and location selection. As an output of a short-term vision plan, this thesis is planned to present to a Turkish university as a department model.

Keywords: Design Education, Automotive - Transportation Design Programs, Transportation Design, Automotive Industry in Turkey / North Cyprus, Automotive Design Education in Turkey / North Cyprus.



ÖZET

OTOMOTİV TASARIM PROGRAMLARININ KARŞILAŞTIRMALI İNCELENMESİ & YÜKSEKÖĞRETİMDE ÜNİVERSİTE - SANAYİ İŞBİRLİĞİ MODELLERİ

ÇUKUR, Efe

Tasarım Çalışmaları Yüksek Lisans Programı

Tez Danışmanı: Dr. Öğr. Üyesi. Can ÖZCAN

Ağustos, 2023

Bu çalışma, i) özellikle otomotiv endüstrisinde uzmanlaşmış mevcut endüstriyel tasarım eğitim programları ile ii) Türkiye ve Kuzey Kıbrıs başta olmak üzere bir otomotiv tasarım eğitim modeli önerisini tartışmayı ve karşılaştırmayı amaçlamaktadır. Otomotiv endüstrisi, dünyanın en büyük 11. endüstrisidir (1,51 trilyon dolar). Otomotiv sektörü öncü bir sektör olarak bilinse de Türkiye'nin yüksek öğretim programları içerisinde uzmanlaşmış bir otomotiv tasarım bölümü bulunmamaktadır. Bu çalışmamız: Avrupa'nın en büyük ikinci otomobil üreticisi ülkesi olan Türkiye ve Kuzey Kıbrıs için sektörün ihtiyaçlarını karşılayan bir program önerisinin sunulmasını da içermektedir. Endüstriyel tasarım eğitimi, eğitim sektöründe gelenekselleşmiş bir bölüm haline geldi. Bunun yanında profesyonel dünyada, otomotiv tasarım stüdyoları; alt uzmanlık alanlarına ayrılmış durumdadır. Yüksek lisans eğitiminde, otomotiv tasarım bölümlerinin; dış tasarım, iç tasarım, kil modelleme, kullanıcı ara yüzü tasarımı ve mobilite gibi alt gruplara ayrıldıkları

görülmektedir. Endüstriyel tasarımın bir alt dalı olan otomotiv tasarımı, Amerika ve Avrupa başta olmak üzere yüksek öğretim programı olarak sunulmaktadır. Bu bölümlerde müfredat, sektörlerin ihtiyaçlarına göre şekillenmektedir. Çalışmanın içeriği, bu eğitim kurumların derinlemesine karşılaştırılması ve bu konuda sektörün ihtiyaç ve taleplerinin nasıl karşılandığının ortaya konulmasıdır. Bazı kurumlar Avrupa ve ABD'den seçilmiştir. İnsan kaynağı, dersler, müfredat ve üniversite-sanayi iş birliği başlıkları altında incelenecektir. Kısa vadeli bir planın çıktısı olarak bu tezin bir Türk üniversitesine bölüm modeli olarak sunulması planlanmıştır.

Anahtar Kelimeler: Tasarım Eğitimi, Otomotiv- Ulaşım Tasarım Programları, Ulaşım Tasarımı, Türkiye / Kuzey Kıbrıs Otomotiv Endüstrisi, Türkiye / Kuzey Kıbrıs Otomotiv Tasarım Eğitimi

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CHAPTER 1: INTRODUCTION

1.1. Problem Definition

The automotive industry originated in the 19th century and continues to play a crucial role in various industries, sectors, societies, and economies globally. It is a significant industrial and economic force in several countries, with its roots in Germany and France. The industry gained prominence in North America during the era of mass production and further developed in Japan, Korea, and more recently, China.

With Ford's breakthrough in mass production, the industry witnessed the emergence of white-collar professionals in industrialization and departmentalization. Currently, the global automotive industry employs approximately 8.4 million people. In the European Union alone, it accounts for 6.6% of total employment, providing direct and indirect jobs to over 12.7 million Europeans. Manufacturing jobs related to the automotive industry make up around 11.5% of total manufacturing employment in the EU, which translates to approximately 3.5 million jobs.

Apart from the workforce mentioned above, professionals such as engineers, salesmen, blue-collar workers, teaching staff, and industrial designers also contribute to the industry. Transportation design specifically holds a significant place within the automotive field.

Transportation design has been seen as essential from the early days of the industry, especially after the introduction of concept cars like General Motors' Buick Y-Job in 1938. In the past, automotive designers were typically educated in engineering and also took art classes. However, until the 2000s, a diverse range of backgrounds, including engineering, architecture, and fine arts, produced automotive designers. Nowadays, vehicle designers are primarily focused on industrial design.

Higher education programs in transportation design are widely available in Europe and America, although they are not as common as industrial design programs. Currently, automobiles are manufactured in 67 countries, with their designs being created in 22

countries (OICA, 2022). In Turkey, there is currently no specialized transportation or automotive design education at the university level. However, there are various design offices specializing in different types of transportation. The rail vehicle and shipping industries often have in-house design offices to train their designers. Due to the lack of formal academic departments for transportation design, these offices typically recruit individuals with higher education degrees in industrial design, product design, and related fields.

This research aims to evaluate automotive design higher education programs and the needs of the automotive industry using the double-diamond design method. The study will present a model by examining the stages of the double diamond framework in which design offices are involved.

1.2 Aim and the Scope of the Thesis

The primary objective of this thesis is to keep light on the professional process of automotive design and conduct extensive research in the field of higher education. Additionally, the research aims to propose a model program specifically for Turkey and North Cyprus as its output. The intention is to develop a model of automotive design programs based on selected criteria in Turkey and North Cyprus.

The ultimate goal of this thesis is to present the proposed model to a regional university and implement it. Through industry-university cooperation, the infrastructure of the automotive design program can be strengthened. Concurrently, this thesis aims to establish a foundation for the program and provide practical exemplification for its implementation.

1.3 Structure of the Thesis

This study presents research into the automotive industry highlighting the designer population of the selected industry. The primary focus of this content is the evaluation of employment for automotive designers within the chosen industry. The second significant point of the research is the analysis of the best transportation design

education programs offered by higher education institutions with the matrix of industry cooperation, syllabus, staff, facilities, etc.

Chapter 2 provides an overview of the automotive industry, commencing from its origins to the industry's employment needs. In this section, the automotive sector is examined separately for both Turkey and the rest of the world. The percentage distribution of automotive designers in automotive R&D offices and the general education levels of employees in their departments are also presented.

Chapter 3 research part of institutes into the main topic of the study. The proposed model reference and the base point are obtained from this chapter. Automotive Design programs are listed according to various criteria, and the design programs are further expanded based on these criteria. Subsequently, twenty-five transportation design programs, which were limited to specific matrixes, were determined. These schools were selected based on their close proximity to design offices and their specific departmental developments. The selection was later narrowed down to four, with the detailed criteria specified for each of them.

In Chapter 4, worldwide and Turkey / North Cyprus university-industry cooperation, the automotive industry, and some selected global automotive design institutes are examined. In this area, examples of university-industry cooperation in Turkey are discussed first. Furthermore, university institutions that form a base for industries are exemplified.

The core part of the thesis is Chapter 5, which is based on the automotive design training programs filtered in the 3rd chapter. It presents a proposal program study locally, and the proposed automotive design model program part is planned at the end of the chapter.

Finally, Chapter 6 concludes the thesis and presents suggestions for the project.

1.4 Methodology

This thesis examines higher education in automotive/transportation design in relation to education, industry cooperation, and industry needs through a literature review and education research. The results are presented with qualitative concerns, and above these, a program proposal model representation is presented.

Several methods of obtaining information were used in this thesis, including observation reviews, literature reviews from the industry and academia, and research of educators and researchers. Before delving deeper into higher education in automotive design, the thesis provides an overview of the automotive industry worldwide and locally in Turkey and North Cyprus. To compare institutes, some design programs are selected based on various criteria. The programs are evaluated based on their curriculum, academic staff, facilities, and industry cooperation. The major group of universities selected is based on their proximity to well-known automotive design offices, cooperation facilities, extended syllabus, and richness in sub-breakdowns of automotive design programs. The values obtained through this matrix are evaluated in Turkey/North Cyprus, and the list of selected institutes is narrowed down from thirty-three to four. Each of the selected institutes is mainly situated near a big Original Equipment Manufacturer (OEM). The research includes a comparison of twenty-five OEMs with universities, followed by a discussion of their respective cooperation.

Furthermore, the thesis discusses progress and design themes in the worldwide and local automotive industry. In the local field, it not only examines the automotive industry but also provides detailed examples of higher education in Turkey.

Lastly, the thesis presents a proposal for an automotive design program under Turkey's conditions. This model provides a summary of the research. By using the history of the European and American automotive industries, their education types and needs are explored, shaped over many decades. While engineering and other main groups can resolve Turkey's education needs, sub-breakdown programs can still be created from a design perspective.

CHAPTER 2: OVERVIEW OF THE AUTOMOTIVE DESIGN INDUSTRY

2.1 Automotive Industry

The term 'automotive industry' was first used at the end of the 19th century (Vaquero, 2018). However, the industry practically began its life in the mid-1800s when automobile manufacturers converted their horse carrier facilities to automobile production. Craftsmen specializing in handcrafted wood and metalwork applied the skills they learned in carriage building to create unique expressions of craftsmanship aimed at affluent consumers. At that time, the automobile manufacturing process was segmented into two separate aspects. Luxury car manufacturers developed the frame, engine, suspension, and any functional or technical aspect, while aesthetic aspects such as bodywork were neglected by coachbuilders who used car builders' chassis and produced vehicles of high artistic value, almost unique sculptures on the chassis.

This marked the start of a completely different approach that focused on the technical aspects of production. The aesthetics of the design were still given importance but mostly as a result of the possibilities and within the limitations of the production methods and materials available at that time. Faced with a choice between an expensive one-off or an affordable mass-produced item, the automotive design industry chose the latter. This new way of car design was touted as uncompromisingly practical and embodied an approach that would become increasingly complex as automotive companies were expected to balance aesthetically satisfying intentions, market forces, performance, functionality, and legal compliance.

In today's world, design has become the main selling point of a car. On the other hand, in the field of finance, the annual turnover of the automotive industry is equivalent to the size of the sixth-largest economy in the world. The main role players in the industry are the US, Europe, and Japan. This industry not only includes Original Equipment Manufacturer (OEM), but it also has the first supplier chain, Tier 1, Tier 2, and so on. All these manufacturers include designers.

2.2 Automotive Design in the Automotive industry

In the world of automobile marketing, customers are mainly drawn towards cars based on their external appearance. Upon closer examination, customers also focus on the car's interior and its design aesthetics. If a car's design is liked by the customer, they inquire about its pricing and technical specifications. This implies that a car sell based on its design, making it increasingly important for OEMs to prioritize their design departments.

While there are no comprehensive statistics available on European automotive employment, the United States of America (USA) is a suitable reference point for such research. According to Zippia (2021), 4% of designers can be found within the automotive industry's white-collar labour force in the US. As design continues to hold a progressively significant role in the automotive industry, this percentage is anticipated to increase further and garner greater importance in the eyes of the consumer.

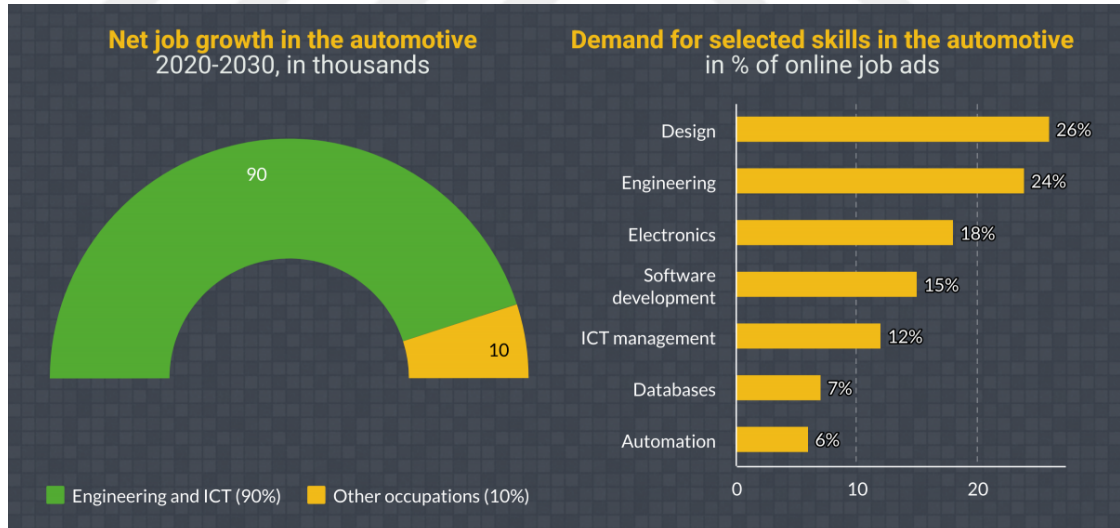


Figure 1. Automotive industry the growth of selected skills chart (Source: Europa, 2021)

It becomes evident that design offices are situated in the second loop to applying the double diamond diagram (Figure 1). The problem is identified by the marketing department while the design office is expected to advance and further refine the original idea. The design process advances through a series of meetings with the

marketing and engineering departments, leading to the project's gradual refinement and minimization of concept options. This meticulous process is deemed to be a complete double-diamond process.

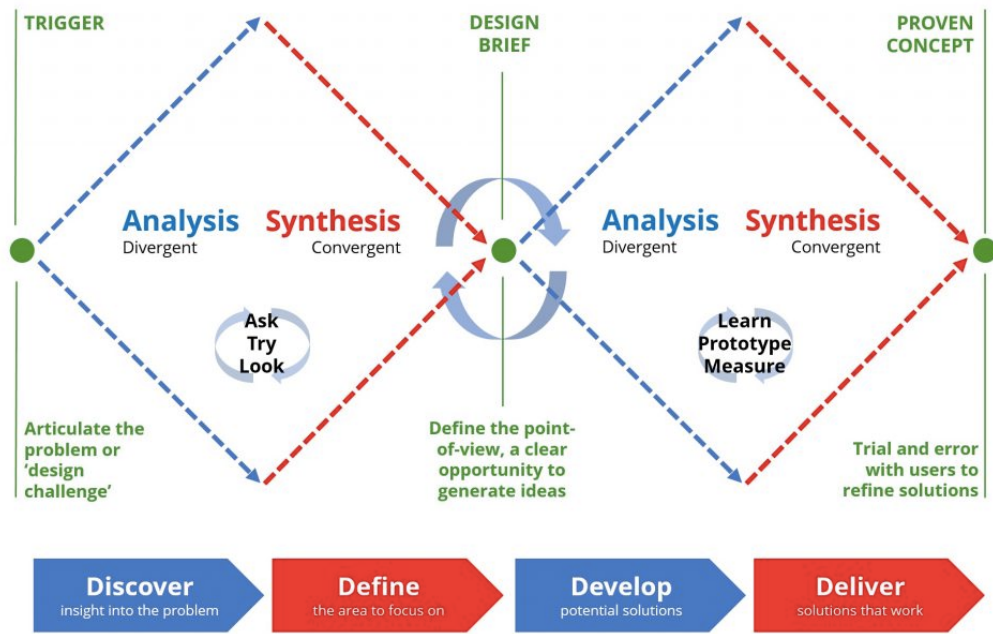


Figure 2. Double Diamond Diagram (Source: UX Magazine, 2022)

As a visual comparison, the workflow of a car project starts with marketing department statistics and market goals. With their brief design department and engineering departments start their 36-month period which ends with Serial of Production (SOP) (Figure 3).

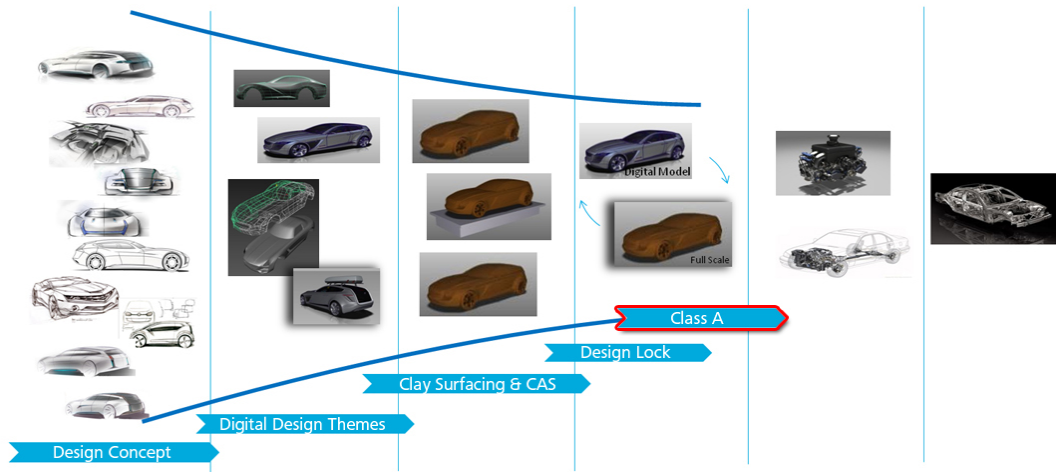


Figure 3. Automotive Design Process (Source: Autodesk, 2022)

Automotive Design departments encompass various specialized roles, such as Sketching, Computer Aided Styling (CAS), Colour and Trim, User Experience (UX), User Interface (UI), Clay modelling, and Perceived Quality. Each role within these departments consists of a team of experts dedicated to their respective areas.

The design team responsible for vehicle development focuses on creating the vehicle's proportions, shape, and surface details. The initial design process involves a series of hand sketches and digital drawings. During this phase, the emphasis lies in capturing ideas rather than refining detailed plans. It is common for designers to produce up to 50 sketches or more, each representing a unique concept. The sketches produced during this stage are characterized by their freedom and lack of constraint. Precision is not a major requirement at this early stage; instead, the focus is on capturing the essence of the concept. The level of detail in the sketches is largely influenced by the individual stylist and the intended visual message being conveyed. Additionally, intuition plays a significant role in understanding the mechanical and ergonomic requirements of the design.

As a result, the final depiction of the design in the stylist's mind is often exaggerated or presented in a caricature-like manner. Each stylist may have their own preference for the type of media they employ in their sketches. While some may perceive the sketches produced by stylists as incomplete, with areas and lines intentionally omitted

(see Figure 4), it is important to note that these omissions are deliberate and done to serve the intended message rather than a lack of skill or necessity.



Figure 4. Informal selection of sketch concept (Source: Created by Author, 2022)

Gradually, more detailed drawings are produced and, after approval by the appropriate level of management, digital rendering of the images. At this point, consumer feedback is generally solicited to iteratively refine the vehicle concept based on the target market and continues through the rest of the design refinement process. After incremental refinement, industrial clay models are developed from the drawings and images. Data from these models are used to create quarter-scale models and eventually full-size models of the final design.

Clay modelling of interior and exterior is the foremost apparent portion of the visible surface car styling movement at whatever point a studio is entered. The clay that's utilised is nearly only limited to the car styling trade and was to begin with by Harley Earl (Happian-Smith, 2002).

Firstly, clay model is designed in a computer program and then "sculpt" it using machines and large amounts of clay. Even in an era of high-quality 3D (three-dimensional) software and virtual models of electric walls, clay models are still the most important tool for the final evaluation of vehicle exterior designs and are used industry widely (Figure 5).



Figure 5. Skoda Clay modelling studio (Source: Auto Design Magazine, 2022)

Car interior designers develop the proportions, shape, placement, and surfaces of dashboards, seats, door panels, roof panels, pillar panels, and more. Ergonomics and passenger comfort are paramount. The procedure up to this point is the same as for exterior design (sketch, digital model, clay model).

Designers take inspiration from other design areas such as Industrial design, fashion, furniture, architecture and sometimes product design. Specific research on global trends will be conducted to design his future 2 or 3 years model projects. From this research, a trend map was created to track design influences relevant to the automotive industry. Designers then use this information to develop themes and concepts that are further refined and tested on vehicle models.



Figure 6. Ital Design Colour & Trim office (Source: Ital Design, 2022)

Colour and trim designers (or colour and material designers) are responsible for researching, designing and developing all interior and exterior colours and materials used in vehicles. These include paints, plastics, fabric designs, leather, scratches, carpets, headliners, the wood he trims and more (Figure 6). Colours, contrasts, textures and patterns must be carefully combined to give a vehicle a unique interior experience. The designer works closely with her designers for exteriors and interiors (Figure 7).



Figure 7. Colour & Trim board (Source: Auto Design Magazine, 2022)

Computer-Aided Design and Class A Development, sketches and renderings are converted to 3D digital surface modelling and renderings and evaluated in real-time using early-stage mathematical data. In the next step during the development process, a fully developed 3D model must meet all engineering and manufacturing requirements, as well as the aesthetic requirements of the designer. The fully developed Digital CAS model has been reworked for production to meet both technical and aesthetic Class A finish standards. This data is further developed by our team of product engineers. These modellers are typically trained in industrial design or tools in the case of some Class-A modellers. Autodesk Alias and ICEM Surf are the two most used software tools for Class A development (Figure 8).



Figure 8. CAS Design Studio (Source: PSH Design, 2022)

In the draft model of the automotive design section, which is one of the main items of the thesis, the above-mentioned software operator, clay modelling experience, mock-ups in the field of UI design and case studies for colour and trim can be included.



Figure 9. Car Clinic (Source: Car Clinic, 2022)

Car clinics are a profitable device for the automotive industry to accumulate understanding from their gathering of people and get their preferences and conclusions about models, current cars, or competitors. The car clinic inquired about a strategy that could be a head-to-head comparison of vehicle brands or models, where the vehicles are lined up in a showroom and members give live input (Figure 9).

This showroom has sound and video recording gadgets and a one-way seeing room to watch members who are enlisted to see the vehicles and give their contemplations on what they like, don't like, lean toward, and other conclusions they may have.

For the most part, a moderator encourages the discussion like a focus group, asking questions to induce members to supply their suppositions. The other option could be a self-administered handle, where members are given a clipboard or tablet and inquired to assess the vehicles (Nicolaidis, 2022).

2.2.1 *Worldwide*

The design is divided into subheadings. And each of them is integrated with some cities. Some cities can be known as centres of fashion design, furniture design, smart tech design or yacht design.

The automotive sector is one of the main sectors in the world, both in terms of employment and financially. This sector, which can be produced in more countries and locations around the world compared to the space and aviation sector, which is a very advanced technological move, touches a lot of people. The fact that it has a relationship with many people in the context of the end-product due to both the mass of people who contribute to the production of automobiles and the customer mass makes automobiles a part of our lives.

The importance of design in automobile sales is undisputed. For this reason, eastern countries such as Japan, Korea; It has design offices in countries such as America and Europe, which are its sales markets. Likewise, it opens these design offices in America, Europe and the eastern bloc. TOGG, which is a local example of this, has a design office in Germany.

Design offices are beneficial to the design process is influenced by the culture of the specific geographical location. This results in the creation of automobiles that resonate with the needs and aesthetic preferences of the people in that region. It is important to highlight that engineering, or any other specialized office is not required in this aspect. Design offices cater to the specific requirements of different locations. As a result, there are offices in Torino, known as the design centre of the world, that offer design services to multiple countries. Similarly, Detroit serves as the design hub for the American automotive industry.

Detroit is the hometown of the big three - General Motors, Chrysler, and Ford and in the past; the 125 auto manufacturers that popped up in Detroit during the beginning of the 20th century.



Figure 10. Detroit's Big Three companies, General Motors, Ford and Chrysler (Source: The Drive, 2022)

Detroit is the starting point of industrialization for transportation designers. Detroit can be named the American way of car making. However, the city possessed inherent advantages that made it ideal for the manufacture of automobiles. Detroit, which is situated in the heart of the Great Lakes region, possessed all the necessary elements for industrial development: it was close to the nation's major coal, iron, and copper mining centres; it was easily reachable by land and water, and it was close to the country's top, long-established production centres.

Turin is a city with a strong design identity; in 2008, it received the first designation of "World Design Capital," and in 2014, UNESCO recommended it as a candidate for the title of Creative City for Design. Turin's economy expanded quickly after World War II, particularly in the automobile sector. Its metropolitan economy is heavily reliant on the manufacturing of machinery and automobiles. Turin is known as the "City of Automobile of Italy" because of the presence of the internationally renowned automaker Fabbrica Italiana Automobili Torino (F.I.A.T.). The city's robust industrial base contributes significantly to the economic growth of the nation. In Turin, the centre of F.I.A.T. and Centro di Stile (Figure 11), the Italian automobile industry, and even the global automobile industry, the automobile sector has always been the backbone

and most symbolic of the city's economy. Due to Turin's heavy reliance on the automobile sector, it played a significant part in the city's economic boom but also contributed to its quick decline in the event of a downturn. Numerous independent car styling studios and design firms have sprung up in the heart of Italy's automobile industry, including the renowned Pininfarina Spa, Gruppo Bertone, Torino Design, etc. Additionally, several top-tier car design professionals, including Giorgetto Giugiaro, Gandini, etc., have emerged. Turin has utilised the entire chain of the research and development industry to shift its export-based economy to one that focuses on knowledge, technology, and know-how. Every year, the global initiative draws vehicle manufacturers from all over the world. Turin is the hometown of Fiat, Alfa Romeo, Lancia, Bertone Design, Pininfarina Design, and New Holland agriculture manufacturers.



Figure 11. FIAT, Centro di Stile (Source: FIAT, 2022)

Pininfarina, one of the well-established companies of Turin, was known for its Ferrari designs in the past (Figure 12). Today, there are architectural projects, product design and design projects in every field of the world automotive industry. Among these projects, there are the first domestic cars of Vietnam, there is TOGG, the pride of our country, and it also has a car with its own name. Design projects within such a wide framework are not only realised by Pininfarina. In addition, many large companies such as Bertone, Ital Design, Turin Design, Icona Design and many others take place as design offices. As an even bigger one of these offices, Fiat Centro Di Stile serves as the European design centre of Stellantis, and the vehicles of all sub-brands sold in Europe, including the American French German, are designed in this centre. Similarity

with Detroit, home to 125 automobile companies, Turin is the centre of automotive design for Europe.



Figure 12. Pininfarina Factory (Source: Classic Car Weekly, 2020)

In order to offer a wide range of design services in Turin, a significant part of the city's workforce consists of automotive designers. Not only do these individuals provide design services to various parts of the world through their offices, but they also educate design students from various corners of the globe in the design schools located in the city. Therefore, Turin serves as a hub where both design services and design education are disseminated.

While the Italians may not hold the highest ranking in terms of manufacturing high-quality cars, they can indisputably be hailed as leaders in the field of automotive design. This distinction can be attributed to the multitude of design institutes they possess, which offer comprehensive education in the discipline. Furthermore, Italian design firms extend their services globally, solidifying their position as premier providers of design expertise worldwide.

As a contrast to the Turin design centre, Germany, one of the leading countries of the automotive sector. Which is known for the spread of engineering offices and sub-industry companies throughout the country. This includes OEM design studios such as Mercedes, BMW, AUDI, Volkswagen and Opel in Germany. In addition, design offices of companies such as FORD, Chery and Toyota began to form in the country.

For this reason, unlike the design centre of Turin, the number of many main industry design offices will continue to increase throughout Germany. The interesting point is that while Milan is the design centre of fashion in Italy, the main reason why the automotive design centre is Turin; The main factory, headquarters and design office of Fiat, Italy's largest automobile company, is located here.

Of the selected institutes in Chapter 3, three out of five university are located in Turin. The only one is CCS in Detroit. All five institutions had many common points. In particular, the subject of university-industry cooperation, which is one of the items forming the basis of this thesis, is among the important features of every university. The fact that professionals, which can be considered as one of the benefits of this, can be considered as human resources also provides benefits for the academicians.

In the exhibitions of IED, IAAD, Poli Design and Pforzheim four institutes in higher education and graduate projects of graduate programs, there are prototyping opportunities, which are also quite common in Turin, and the ease of access to the production workshops of 1/1 mock ups and concepts (Figure 13).

One of the benefits of meeting industry and university in the same city is to be in the same lantern as a network. Thus, universities can easily bring professionals and students together at graduation exhibitions or events. This is a factor that makes it easier to expand the communication channels of both career offices and students.



Figure 13. Graduation Exhibition (Source: CCS, 2023)

The design capital of Turin, which is discussed in this section, is exemplified by how strong the bridges between educational institutions and industry are. Turin is a very practical example for increasing the importance of design in the automotive industry and for the industry to gain value through design.

In addition to the city, it is a centre where automotive design education can be taken as a reference for higher education institutions and where there are good and bad examples.

As a result, it is seen where the 2 cities, which are called the automotive design capital of Europe and the automotive production capital of the USA, come from and live with these titles today. It is not just hosted by many companies. At the same time, they are the capital of designer education, and they are also the homeland of automotive designers with high brand value. Because vehicles that have not yet entered production are tested on the streets of these cities, company employees interact with the people of that city and create an ecosystem.



Figure 14. Top 10 Vehicle Production Companies (Source: Maps of World, 2018)



Figure 15. Europe and the United States of America's main automotive design studios and transportation design higher education centres (green dots for institutes, red dots for design studios) (Source: Created by Author, 2023)

It can be seen that; production and factories are spread all over the world (Figure 14). However, the design centres in Europe and America are located in a much more limited area. In addition to these, the location closeness of the design offices of the well-classified higher education institutes of vehicle design can be seen (Figure 15).

2.2.2 In Turkey / T.R.N.C.

In Turkey's perspective, industrial Design graduates can work in several transportation sectors such as agriculture machine, construction machine, bus-truck heavy vehicle industry, rolling stock, UAVs, defence vehicles, Light-Weight Commercial Vehicle, automotive, Bicycle and motorcycles, Yachts and ships etc. Professionals of the people they employ in the product development units of companies in Turkey It has been observed that the profiles of industrial products are mostly engineers. Although the working rate of designers is not low, concept design. It was observed that it was insufficient when compared to the companies that stated that they did so (Arer, 2010).

The main locomotive industry of transportation design can be seen as the automotive sector. In Turkey, the only main automotive sector manufacturers are TOFAŞ, Oyak Renault, Karsan, TOGG and GÜNSEL. In these five companies, Karsan used the French manufacturer Renault Megane licence for the Turkey assembly facility. TOFAŞ also uses the Italian Fiat Group licence for assembly. But with the help of the FCA R&D centre located in TOFAŞ and its strategic Turkey Market position, TOFAŞ has Industrial Design labour.



Figure 16. Turkey & North Cyprus Automotive and Heavy Commercial Vehicles Design Offices (Source: Created by Author, 2023)

The design offices of automotive and heavy vehicle-construction equipment companies in Turkey and Northern Cyprus are marked with the pins on the map above. These include FORD Sancaktepe, Hexagon Studio, TOFAŞ, TemSA, Otokar, Hidromek, DesignUm, Sedat Öztürk Design Studio, Amperino, TOGG and GÜNSEL. As that be seen these selected design offices are based in Istanbul, Kocaeli and Bursa. This is again the dominant position when various agricultural, construction equipment, 2-wheeled vehicles, which are not marked here, as well as the production factories of these companies are involved. For this reason, Bursa is a centre where design and production meet both as an industrial city and a bit outside the metropolitan density. It is similar to the fact that, despite being a design capital like Milono, Turin has the title of automobile design capital thanks to institutions such as FIAT Centro di Stile.



Figure 17. GÜNSEL & TOGG (Source: Kıbrıs Postası, 2022)

Bursa is the city called the industrial capital of Turkey. The main industrial factories that increase the employment of Bursa the most are automotive companies such as TOFAŞ, OYAK Renault, Karsan and the recently formed TOGG. With the subsidiaries and sub-industries of these companies, Bursa has an important place in the automotive field in Turkey. The preference for Bursa over a port city like Istanbul during the establishment period of TOFAŞ enabled the bursa industry to take its first steps. And it has made it a city of the automotive industry. The most important factor in the election of Bursa is that the minister of industry of the period insisted on making this investment in Bursa. Otosan, another KOÇ group automotive company, continued its production in Istanbul at that time. TOFAS R&D was established in 1994 again in Bursa. After the establishment of the TOFAS R&D establishment, many automotive companies started to open their R&D ventures in Bursa. The automotive industry and universities benefited greatly from this issue.



Figure 18. TOFAŞ R&D (Source: TOFAŞ, 2017)

Turkey is a unique geography between Europe and Central Asia that has turned its face to the west, but its people also carry traces of eastern culture. For this reason, he tried to adapt the automotive trends and production techniques he followed in Europe to Turkish life. One of the best examples of this is the "Dolmus", which is suitable for the production of Turkey and the Turkish lifestyle, which is often seen in traffic. Dolmus is the cheap public transportation that many people prefer for short distances such as taxi. These vehicles, which can be done on and off, are mostly made by minibuses produced in Bursa today. Even in minibuses coming from Europe, seat manufacturers in Bursa have to change the interior arrangement according to the Dolmus seating arrangement.

As a result of this, Uludağ University, the largest institution in the city, actively engages in industrial collaboration in order to harness the potential of the population residing in Bursa and studying at the university in the automotive sector. Within this framework, R&D employees from companies such as TOFAS, Renault, and Ford Otosan contribute as consultants in engineering faculty course projects or collaborate with professors in the development of project briefs. This fosters the establishment of a network with graduate students, creates a conducive environment for undertaking academic projects within the scope of TUBITAK, and enables the university to stay updated with current industry developments.

The Turkish automotive industry gained momentum, particularly in the 1960s, when the KOÇ group initiated mass production with the first Turkish brand called ANADOL, following their truck production under the Ford license. This factory was established in Istanbul with a significant labour force and played a pioneering role in the professional growth of numerous engineers and designers. Subsequently, the diversity of manufacturers in the sector increased with the production of Ford-licensed products by OTOSAN, a subsidiary of the KOÇ group, and the establishment of TOFAŞ, a Fiat-licensed company with a sister organization. The entry of Renault, licensed by the military fund OYAK, into production in Bursa showcased that the sector was competitive beyond the KOÇ group. SABANCI's TemSA, which commenced production in Adana using Mitsubishi technology, along with the KOÇ group's establishment of tractor and engine factories in regions like Eskişehir and Ankara, formed a production network that spread throughout the country.

During the same period when automotive industry was localized the with ANADOL, South Korea was taking similar steps on a global scale. Just as ANADOL acquired licenses from British FORD and Italian FIAT, Korea also obtained the Japanese Mitsubishi license and established Hyundai with the support of the Korean government. Hyundai was the largest iron and steel producer of that period and ventured into the automotive industry with state backing. Kia also existed as a subsidiary company. Additionally, an automotive company named Samsung was established during a similar timeframe, and these companies have become one of the top 5 global automotive groups, experiencing continued growth to this day.

The bus-truck industry constitutes the primary export items. Companies such as Otokar and Anadolu Isuzu not only manufacture heavy-duty vehicles and mid-buses but are also involved in the defence industry. They provide services in both areas through their design offices.

The first Turkish automobile design is ANADOL-Bocek (Figure 18). Unfortunately, these vehicles were produced in very limited quantities and have since become collectibles. ANADOL-Bocek is a buggy-type vehicle with only a few examples in the industry. Its designer, Jan Nahum, is the son of Bernard Nahum, who served as the automotive manager of the KOÇ group at that time.



Figure 19. ANADOL Böcek (Source: Klasik Otom, 2019)

Due to the recent pandemic, there has been a shift towards a more localized lifestyle, resulting in the development of more efficient shipping processes to reach customers. Additionally, the use of individual modes of transportation, such as scooters and single-person vehicles, has become increasingly popular in cities, surpassing the preference for public transportation. Consequently, the market for L6-L7 class micro city vehicle motorbikes, including L1, L3, and scooters, has experienced significant growth. These vehicles heavily rely on joint production and parts sourced from the motorcycle and automotive industries. As a result, start-up manufacturers have emerged in Bursa and its surrounding areas. However, due to their limited product range and their relatively new presence in the industry, these companies currently employ very few designers.

From a broader perspective, the transportation industry, encompassing all sectors, is substantial. Numerous companies are situated mainly in the Istanbul-Kocaeli-Bursa triangle, with new entrants in the Ankara-Konya and North Cyprus regions. When evaluating these companies using the double diamond theory outlined in Chapter 1, it is evident that most of them operate within the second diamond. In some cases, the design concept and the 1.5 loop area are outsourced until a single product family is achieved. This outsourcing practice contributes to the scarcity of automotive designers and the lack of automotive design education in this city. However, by reversing this

trend and establishing educational institutions with internships and collaborations within the automotive sector, skilled professionals can be cultivated even before university education.

Turkey holds a leading position as one of the world's largest marine-yacht production centres. Presently ranked third globally in terms of total yacht building feet, following Italy and Holland, Turkey's strength in this field is attributed to its extensive manufacturing history and the creation of bespoke furniture. This phenomenon has resulted in a well-established education system within the country's marine sector. In recent years, several Turkish institutions have focused on raising the proportion of design projects in this sector. The progress in education began in the 1990s, with the establishment of departments in areas such as technicians, naval construction engineering, and yacht design. Yacht design has been effectively integrated into educational programs, including interior architecture and industrial design. The largest and busiest facility at the university, the laboratory, not only serves as a hub for faculty instruction, research, and development, but also offers consulting services to Turkey's marine industry. As a result of its expanding research capacity and knowledge, this consulting service has recently expanded internationally. Moreover, there are four universities in Turkey with shipbuilding departments, namely Istanbul Technical University, Yıldız Technical University, Piri Reis University, and Karadeniz Technical University (OECD Council Working Party on Shipbuilding Report, 2011).

Similar to the maritime sector, the automotive sector is an integral part of the transportation industry. The commonalities and educational prerequisites between these sectors are evident. Instead of naval engineering and yacht design, automotive engineering and automotive design play crucial roles. As the number of shipyards in Turkey has increased, so has the importance placed on education. This indicates that the developing automotive sector in our country could follow a similar trajectory. Many universities in Turkey offer higher education in automotive engineering, with automotive design being the next focus.

Besides of that, transportation design can adopt a similar approach, establishing a comprehensive training and application program. One of the objectives of this thesis is to provide examples of this approach.

CHAPTER 3: AUTOMOTIVE DESIGN PROGRAMS

Transportation design is a subfield of industrial design that encompasses several areas, including interior and exterior automotive design, colour and material design, and CAS design. These areas make up a comprehensive automotive design program.

In transportation design departments, automotive design is a widely discussed topic, irrespective of whether the department offers yacht design programs or not. For this reason, this study considers transportation and automotive design programs as part of the same academic field.

This chapter provides an overview of the world's leading automotive and transportation design departments, compares and examines four selected schools based on specific criteria, their curricula, academic staff, course details, and university-industry collaborations, as well as evaluating them using the double diamond diagram.

The discussion encompasses factors that are advantageous for automotive designers in terms of research, problem-solving, design creation, and completion. The matrix analysis shows that certain institutes excel in research and academic areas while others have strengths in promoting creativity and conceptual design education.

3.1 An Overview of Transportation & Automotive Design Programs

This study explores the best transportation design programs worldwide, with automotive industry centres in Japan, America, and Europe also serving as reputed homes to transportation design education.

Design and designers gained significant recognition from the Renaissance era, particularly in Italy and Europe, resulting in a widespread adoption of design education across Europe. In the United States, a highly competitive market, rapid consumer goods and consumption ecosystems have formed, leading to increased emphasis on technology and design to gain a competitive edge.

According to this research, twenty-five institutions have been listed in the field of transportation design, with reference to the titles of university-industry cooperation, curriculums suitable for matrices, cooperation of the academicians and the educational institution with the industry. All of these institutes are listed as best of automotive design education in the world from online design publishers (Car Body Design, Driving your dream, Mantra):

POLI Design, Lahti University of Applied Sciences, Umea Institute of Design, IED – Istituto Europeo di Design, Braunschweig University of Art (HBK), Universidad Politécnica de Valencia, ISD France, Domus Academy, Pforzheim School of Design, IAAD – Istituto di Arte Applicata e Design, Art Centre College of Design, TU Delft, ISSAM, SPD Scuola Politécnica di Design, Creapole, Northumbria University, Staffordshire University, Coventry University, Swansea College of Art, Huddersfield University, Royal College of Art, Lawrence Technological University, College for Creative Studies-CCS, Academy of Art University, University of Cincinnati, National Institute of Design (NID), DSK-ISD India, MAEERs MIT Institute of Design, Mantra Academy, DYP-DC, Icon Design, Tokyo Communication Arts.

As defined in the second chapter (Figure 2.15). Nearly all of these institutes share the same cities as OEM design studios. These educational institutions have close relations with automotive companies and R&D offices located in the same city and in the same country. These institutes have several education types from courses to post-doctoral.

These twenty-five institutions were narrowed down to five institutions for the same reasons. Five institutions are separated from each other by detailed nuances. It formed the basis of our research on the perception of details.

In the matrix below, there are some criteria. Program, courses, staff, internship and facilities are main groups. These groups and subgroups are selected to differentiate and compare the institutions and programs. Specifically, ergonomics, engineering, history, material, colour and modelling tool- Alias courses are in the list.

The reason for choosing the subject of ergonomics is that the interior and exterior design of the car is also human-oriented. It is impossible for this design to be far from human ergonomics. Vehicle design is limited by ECE and SAE standards. While

designing the exterior and interior of the vehicle, that must both maintain the SAE J1100 standard and maintain the protective living space according to material movements during an accident. The design process is completed with the awareness of these ergonomic rules in every area of design.

Engineering title is a general course title. Here, some institutions give engineering, vehicle packaging or manufacturing course names, while some institutions limit it to the subject of aerodynamics. Considered under the umbrella of engineering to cover them all. In the automotive design process, the design office receives a brief from the marketing team, as well as packaging files and aerodynamics targets from the engineering team. The design process takes place within the confines of the packaged vehicle. It is also essential to make producible design here. For these reasons, the title of engineering has been added to the matrix.

History lesson is in every program from industrial design to transportation design to colour n trim program. The reason is while some institutions do this specifically for automotive design, some institutions add the history of the industry to it or detail the history according to nationalities. Since this diversity was observed, history was also included in the matrix.

The material course is necessary for the designer's output to be realized. An interior designer cannot design a product without knowing the capabilities of the material or its touch. The area where this is even more inclusive is the colour & trim branch. Material change and decision in this branch is the whole process.

The reason why colour content is separate is that some institutions teach colour and material courses separately, while others teach them together.

Modelling tool - Autodesk Alias course was chosen because almost all of the industry uses Alias. Programs such as rhino, maya, ICEM surf are in active use, too. Even some design offices still have CATIA. However, due to the surface quality and the fact that every designer has mastered the same program, alias has become a widely accepted program in the sector. The reason why it is not preferred in other sectors is that only

transportation designers need it and every designer who graduates from this department is expected to be a foundation.

The reason why there are two sub-groups under the name of internship or competition as a sub-group of Internship is that some institutions find internship and competition participation valid in equivalent credits.

Five universities -Istituto Europeo di Design (IED), College for Creative Studies - CCS, Istituto D'Arte Applicata e Design (IAAD), Poli Design and Pforzheim University - program types were evaluated in the areas of staff backgrounds, facilities, core courses for automotive design and internship programs. All these universities have OEM formal cooperation and share hometowns with them. The ergonomics, alias software, aerodynamics, automotive history, and material listed in the core courses were evaluated in the colour matrix.

Besides of these universities there are well known institutes who have successful graduates all over the industry. As examples, UMEA, Reutlingen, Coventry and Royal College of Art can be represent. In this research these four institutes are not listed.

Firstly, the reason of Umea has only post graduate program. Poli Design used in here with the same technical background.

Royal College of Art is not listed, too. Because it converts the transportation education to a modernized area which is intelligent mobilite. The program content is wider than transportation, they also take responsibility about environment and people living. Intelligent mobilite is the near future of the industry but in here transportation and automotive design education is focused on.

On the other hand, Reutlingen is progressing in detail on automotive interior projects and in partnership with textile design. However, there is only the undergraduate level interior design department in this institute. Other organizations provide several automotive design programs in more than one program and levels. However, Reutlingen has much more focused on material and colour education with the comparison of other selected ones.

Coventry is a well-known institution like the Royal College of Art. The institute, which provides education in a wide variety of branches, provides 3 undergraduate and postgraduate programs under the name of automotive & transportation. However, undergraduate programs have many common courses with other fine arts departments. The university does not focus on transportation design. Transportation lessons are infrequent. More transportation courses are taught in the IED Product Design program. Coventry is not among the university that meet the acceptance list of design studios competitions such as Pininfarina or Porsche design.



Table 1 - Matrix of selected five Institute (Source: Created by Author: 2023)

		Program				Course					Staff		Internship		Facility
		Course	Bachelor	Master	Doctoral	Ergonomics	Engineering	History	Material	Colour	Modelling tool - Alias	Industry	Academic	Industry agreement	Competition
IED	Transportation Design		+	+		+		+	+	+			+	+	+
	Product Design - Pathway in transportation Design		+			+	+	+	+	+			+	+	+
	Autodesk Alias	+				+				+			+		
	Car Design - An Introduction	+											+		
CCS	Transportation Design, (MA,MFA)		+	+						+			+		+
	Dunning Automotive Design Pre College Summer Scholarship	+													
	Clay Modelling	+													+
	Alias 3D Modelling	+								+					
IAAD	Transportation Design		+	+		+	+	+		+			+		+
Poli Design	Transportation & Automobile Design			+		+	+	+	+	+		+		+	+
Pforzhei	Transportation Design		+	+		+	+	+	+	+			+	+	+

The reason for the listed courses for the matrix is the branches in the automotive design studios in the sector. These are colour and trim (CnT), computer-aided design (CAS),

Exterior design, interior design, clay modelling, and User Interface design. As it is understood from the sub-branches, the aerodynamics course is very basic for exterior designers, clay models and CAS modellers. In addition, CnT designers should be experienced in the field of material and colour. UI designers and CnT designers need colour knowledge. And it would be beneficial for every designer working in this field to know basic automotive design history.

3.2 Selected Transportation Design Programs

As observed above, there are similarities as well as elements that create a distinction. The selection of these five institutes has provided differentiation in areas such as location, partnerships, training types, and focus groups.

Institutions apart from IED offer education in undergraduate and higher classification. The reason for this is that IED provides training in eleven locations. Furthermore, IED provides to offer education to individuals in every region through online courses in numerous programs. Conversely, the other four institutions provide on-site undergraduate and higher education using traditional methods.

On the contrary, CCS has expanded diversity by introducing two different master's programs, one with a thesis and one without a thesis.

3.2.1. Schedules - Curriculum

3.2.1.1. Istituto Europeo di Design S.p.A. (IED);

IED is a fifty-year-old institution with an extensive network spread across three countries and twelve different locations. Transportation Design also offers ten various programs at undergraduate and graduate levels in centres such as Turin and Barcelona. This shows that these programs hold a standard in every institution of the university in various branches such as human resources and university-industry cooperation.

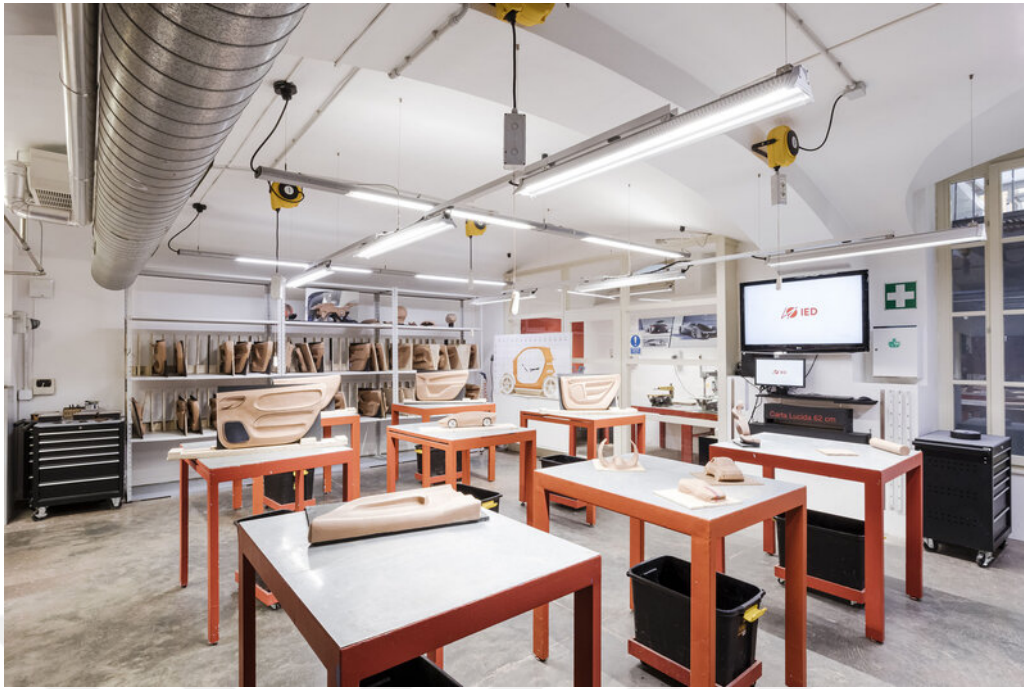


Figure 20. Istituto Europeo di Design S.p.A. (IED) (Source: IED, 2022)

3.2.1.1.1. Bachelor's Degree, Transportation Design

Table 2 - IED Transportation Design, Undergraduate Program's Schedule (Source: IED, 2022)

1st YEAR	Credits	2nd YEAR	Credits	3rd YEAR	Credits
Design 1	8	Design 2	10	Design 4	10
Technical and design drawing	8	Design 3	6	Design 5	10
Design methodology	4	Drawing techniques and technologies	4	3D rendering	8
Modelling 1	4	Modelling 2	4	Modelling 3	4
Graphic design	8	Digital modelling techniques - 3D computer	10	Phenomenology of Contemporary Arts	6
Illustration	4	Sociology of cultural processes	6	Foreign Language	2
Theory of perception and psychology of form	4	Design management	6	Elective courses	6
Interdisciplinary seminars / Interdisciplinary workshops	4	Elective courses	4	Internships / Career guidance + Competitions	
History of contemporary art	6	Interdisciplinary seminars	2	Thesis project	10
History of design 1	4	History of design 2	4		
Type of materials 1	6	Type of materials 2	4		

As per the curriculum at Istituto Europeo di Design S.p.A., the first year is an introductory phase, aiming to help students acquire the method, basic technical, cultural, and creative tools. Mastery of technique and tools will enable learners to control the creative flow, thereby developing, analysing, summarizing real-world scenarios and ideas, and converting creativity into design. The second year emphasizes experimentation and practical application of the method, tools, and theoretical knowledge in designing activities. The third year's objective is to enhance autonomous learning and develop necessary skills in advanced design to benefit the students' professional world.

While observing the curriculum, it can be noted that the history and material courses span across two years. Furthermore, additional credit is offered for competitions and internships, which sets this program apart as the sole one on our list to reward competition participation. Regarding the course schedule, it is evident that there is a Contemporary art history course and a design history course, but a transportation design history course is notably absent. No information regarding this specific course can be found in the provided descriptions, indicating that the program does not prioritize transportation-focused courses. The comparison does not include the content of studio courses.

While Ergonomics and Aerodynamics may not be listed as individual courses, the explanation in the syllabus for the first year states that basic theoretical training topics, such as ergonomics and aerodynamics, are covered. Therefore, it can be inferred that these topics are indeed included in the course content.

3.2.1.1.2. Bachelor's Degree - Four years - Product Design / Pathway in transportation Design;

Table 3 - IED Product Design, Pathway in Transportation Design Undergraduate program's Schedule (Source: IED, 2022)

1st YEAR	Credit	2nd YEAR	Credit	3rd YEAR	Credit	4th YEAR	Credit
PROJECT FOUNDATION I 6	6	COMPUTER TOOLS FOR PRODUCTS I	6	LAB FOR PRODUCT DESIGN I	12	PROFESSIONAL INTERNSHIP	6
REPRESENTATION TECHNIQUES I	6	MULTIDISCIPLINARY WORKSHOP I	2	TECHNOLOGY FOR PRODUCT DESIGN II	6	INTERIOR DESIGN TRANSPORTATION PROJECT	6
PROJECT COMMUNICATION I	4	INTERDISCIPLINARY PROJECT I	4	MULTIDISCIPLINARY WORKSHOPS II	2	MOBILITY PROJECT	4
INTRODUCTION TO MARKETING	4	Development Module		TWO WHEELS MODULE		PROJECT DESIGN MANAGEMENT	4
SCIENCE APPLIED TO DESIGN	4	ERGONOMICS PROJECT	3	TWO WHEELS PROJECT	4	PROJECT COMMUNICATION FOR PRODUCT DESIGN II	4
COLOUR AND FORM	3	TECHNICAL PROJECT	4	PROJECT COMMUNICATION FOR PRODUCT DESIGN I	4	LAB FOR PRODUCT DESIGN II	4

PROJECT FOUNDATION II	6	REPRESENTATION TECHNIQUES FOR PRODUCT DESIGN I	4	TRENDS	4	MULTIDISCIPLINARY WORKSHOP III	2
REPRESENTATION TECHNIQUES II	4	DOMESTIC PROJECT	4	NAUTICAL MODULE		FINAL PROJECT	30
PROJECT COMMUNICATION II	6	TECHNOLOGY FOR PRODUCT DESIGN I	6	NAUTICAL PROJECT	4		
TECHNICAL DRAWING I	4	SEMIOTICS	4	COMPUTER TOOLS FOR TRANSPORTATION DESIGN	8		
SOCIOLOGY	4	Styling Module		EXTERIOR PROJECT MODULE			
VOLUME I	3	HISTORY OF PRODUCT DESIGN	4	EXTERIOR PROJECT	4		
HISTORY OF ARTS AND OF DESIGN	6	STYLING PROJECT	6	PROJECT COMMUNICATION FOR TRANSPORTATION DESIGN I	4		
		VOLUME FOR PRODUCT DESIGN	3	PERSONAL DEVELOPMENT PROJECT MODULE			
		PACKAGE PROJECT	6	PERSONAL DEVELOPMENT PROJECT	4		
		TECHNICAL DRAWING FOR PRODUCT DESIGN I	4	MARKETING	4		

This program is situated in Barcelona. This city is not a hub for transportation design, because of that this program carries the title of product design. Moreover, the program's focus includes a larger number of product design-based courses compared to the Turin program. It is also worth noting that this program has a duration of four years, which sets it apart.

During the four-year undergraduate education, the second, third, and fourth years are divided into modules, allowing students to take courses based on their areas of expertise. In accordance with the double diamond framework, the discovery phase is emphasized with numerous lessons during the first and second years. The third and

fourth years concentrate on project-based lessons and the development and delivery sections. The latter part of the double diamond framework is reinforced through the completion of a final project.

Unlike IAAD, the IED does not separate the motorcycle program. However, the yacht design program follows the common practice of being divided. The two-wheel program is included in the four-year bachelor's degree as a module. Notably, the trend course is unique to this module, as it is not found in the other modules. Additionally, the inclusion of a marketing course in the personal development project module, as an option in the second semester of the 3rd year, differentiates it from other schools.

The IED has responded to the emerging trend of mobility, which is considered a new development in the current automotive sector. Through mobility projects introduced in a course from the previous year, the program covers not only traditional vehicle design but also sub-branches such as last-mile delivery vehicles and micro-mobility, providing training in these areas.

In contrast to the other four institutes, the IED includes sociology and semiotics as courses, whereas they are considered additional topics in the other institutions' curricula.

3.2.1.1.3. *Master's Degree, Transportation Design;*

Table 4 - IED Transportation Design, Graduate Level Program's schedule (Source: IED, 2022)

1st YEAR	2nd YEAR
History of Design	Design Management e Project Communication
Vehicle Engineering	Product Positioning
Interaction Design	Portfolio
Colour n Trim	Advanced Design & Intelligent Mobility
Lectures and Visits	Lectures and Visits
Tech Drawing	Alias
Illustration	Maya
Photoshop	Photoshop
Alias	
Maya	
Clay	

In this program positioned under the Fine Arts, theoretical courses; Technical modelling lessons have also been added. Being in vehicle engineering in theoretical education provides benefits in the coordination of designers with engineers in the sector. There are a lot of 3d surface models practised in institutions such as CCS. It is a plus that there is the Autodesk Alias at the master program level here as 3d modelling education tools. In addition, it is surprising that there is Autodesk training used by some companies such as the Alias. It's a lesson that haven't seen in other institutions. In addition, it is a plus to have a clay modelling course in the first year of education. Having the colour and trim course is very useful for capsule knowledge. In addition, for transportation education to be future-oriented, the students were given a vision for the vehicles of the future with the advanced design & intelligent mobility course.



Figure 21. IED Barcelona Clay modelling studio (Source: IED, 2022)

Clay model workshop makes positive affects to students could be able to experience creating their own bonds between sketch and full-size products (Figure 21). As with the IED Mitsubishi association, the student can be able to experience what he/she has to deal with in the protective ecosystem of the school before modelling companies such as Freeland.car, MINTT, AM Costruzione Modelli, and Raitec produce prototypes (Figure 22).



Figure 22. Mitsubishi Moonstone concept by master students of IED (Source: IED, 2023)

3.2.1.1.4. Course, Car Design- An Introduction:

Table 5 - IED Car Design Course's Schedule (Source: IED, 2022)

1. Week	2. Week	3. Week	4. week
Day 1 Morning: Orientation and introduction to the course and instructor. Review of the syllabus, class activities, and general information. Introduction to the Profession and Industry. Afternoon: Freehand Sketching	Day 5 Morning: Digital Sketching Afternoon: Clay Modelling Lab Day 6 Morning: Digital Sketching Afternoon: Clay Modelling Lab Day 7 Morning: Digital Sketching and Rendering Afternoon: Field trip	Day 9 Morning: Lecture Afternoon: Clay Modelling Lab Day 10 Morning: Field trip Afternoon: Clay Modelling Lab Day 11 Morning: Field trip Afternoon: Clay Modelling Lab	As Final Project, together with your classmates, you will assemble a portfolio to document both your progress in mastering “car sketching” as well as to show your ability to create original car drawings. In addition, you will complete basic clay modelling projects as a first step of the whole design process.
Day 2 Morning: Field trip Afternoon: Freehand Sketching	Day 8 Morning: Digital Sketching and Rendering Afternoon: Clay Modelling Lab, Designer Demo	Day 12 All day: Project completion and presentation setup	
Day 3 Morning: Freehand Sketching Afternoon: Sketching exercises		Day 13 Final presentation	
Day 4 Morning: Lecture Afternoon: Digital Sketching			

The purpose of certificate programs is not to reinforce the design process but rather to focus on research. The curriculum and course mission align with this objective and primarily revolve around teaching the design process, which is the second diamond, as illustrated in the double diamond diagram. Details of this process, such as the development and presentation phases, are covered in certificate programs.

This four-week certificate program at the introductory level provides students with a chance to engage with industry professionals and get hands-on experience through

practical training and guided tours at Pininfarina, Ferrari, Automobile Museum, Cecomp, and Sabelt.

Students can learn the language of full-body design through clay modelling with the support of this certificate program. The final week of the course program is dedicated solely to the final project. Note that since this is an introductory level certificate program, project deliveries are relatively simple, akin to completing a basic clay model. As such, the overall process is not rigorously evaluated. This training program primarily aims to provide a general understanding of the subject while developing practical skills.

The course's focus is mainly on physical elements; therefore, instead of being loaded with theoretical-intensive courses such as 3D modelling or colour and material, course obligations that increase hand practice habits, such as clay modelling and sketching, are covered in the program.

3.2.1.1.5. Course, Autodesk Alias;

A short (150 hours) program and training in Italian are provided. But even in the short training, an ergonomics lesson is added.

Each education year, the IED can open new programs and remove existing ones. However, the five programs that have been chosen above can be seen among the basic programs of the university. All of them have common points and detailed areas where they differ. As the main common point, students who are the educational theme of the university; discover new future areas of mobility and to open up design repertoires. There is no focus on the motorcycle or super sports vehicle designs or technical lessons. These are the programs that try to gain a design philosophy.

When evaluating IED based on its curricula and program types, it does not mainly focus on providing training for operatorship designers. Instead, it aims to enable designers to anticipate the future and develop a design philosophy. In order to become proficient in these areas, students are equipped with the necessary tools to develop their operational skills.

3.2.1.2. *College for Creative Studies (CCS);*

College for Creative Studies is a non-profit, private college authorized by the Michigan Education Department to grant bachelor's and master's degrees. It is recognized as one of the leading transportation design institutes in America. Originally established in 1906 as the Detroit Society of Arts and Crafts, the institution has gained prominence, particularly through its industry connections. Major automotive companies such as GM, Ford, and Chrysler provide funding for the college. The main campus building of CCS is housed in a former GM factory, while another campus has been donated by Ford.

Notably, the college incorporates industry input into studio projects. Briefs for these projects come from the three major automotive manufacturers as well as suppliers, and professionals from the industry actively participate in the studios.

All faculty members at CCS have prior experience working in design studios or continue to be involved in design-related roles. This direct link between industry updates and the educational institution enhances the curriculum and ensures students receive relevant and up-to-date knowledge. Additionally, CCS has established strong ties with the industry through its career service office and end-of-term project presentations, which provide opportunities for students to connect with potential employers and find desired job opportunities.

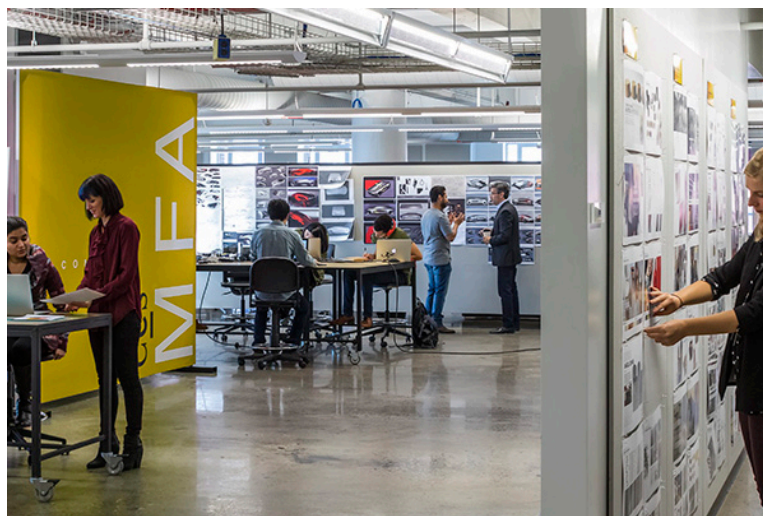


Figure 23. College for Creative Studies (CCS) (Source: CCS, 2023)

3.2.1.2.1. Bachelor's Degree, Transportation Design;

Table 6 - CCS Transportation Design Undergraduate program's Schedule (Source: CCS, 2022)

1. Semester	Credits	2. Semester	Credits	3. Semester	Credits	4. Semester	Credits
CCS First Year Experience	1	Visual Communication II	3	Junior Vehicle Design Studio	3	Senior Vehicle Design Studio	3
Drawing I: Rapid Concept	3	Design Theory I	3	Visual Communication IV	5	Art History or Visual Culture Elective	3
Process & Making	3	Digital Modelling I	3	Digital Modelling III	3	General Education Elective	3
2D Design or 3D Design - Form & Space	3	Sophomore Transportation Design Studio	3	Portfolio & Presentation Design	3	Elective	3
Freshman Transportation Design Studio I	3	Western Art History/Visual Culture	3	Vehicle Systems & Packaging	3	Senior Vehicle Design Studio	3
Composition I	3	General Education Elective	3	Survey of World Literature	3	Natural Science	3
Drawing II: Style & Skill	3	Visual Communication III	3	Junior Vehicle Design Studio	3	General Education Elective 3	3
2D Design Principles or 3D Design - Form & Space	3	Design Theory II: Mobility	3	Materials & Manufacturing Processes	3	General Education Elective	3
Digital Techniques	3	Sophomore Transportation Design Studio	3	Visual Communication V	1.25		
Visual Communication I	3	Digital Modelling II	3	Digital Modelling IV (Visualisation) Digital Modelling IV (A-class)	3		

Freshman Transportation Design Studio II	3	Human Factors	3	History of Modern Design	3		
Composition II	3	Visual Narration: Asia or Visual Narration: Africa/America	3	Business Practices	3		

The first-year education is more drawing-oriented and it is aimed that the students can put their thoughts on paper in the first year. expertise gained in the years that followed.

There are no courses about Colour or Material. As a school MA MFA included in the program in the field of Colour & material. This bachelor's degree program is mostly based on surface modelling. There is even an A-class surface course. CCS, which provides training in visual communication courses; digital modelling and rendering programs, has fallen far above this subject. A visual communication class is held each year.

With a course such as Visual Narration, automotive design program varies according to nation and countries have a design identity just like company identity. This course in the sub-programs of the other four institutions.

There is no ergonomics course, but a similar basic education is provided with the human factors course.

With the third year courses such as Materials & Manufacturing Processes and Vehicle Systems & Packaging, the institution showed the subjects that the design offices in the automotive sector encounter with the engineering teams with the course contents.

3.2.1.2.2. Master of Arts, Transportation Design;

Table 7 - CCS Transportation Design Master of Arts program's Schedule (Source: CCS, 2022)

1. year	Credit
Transportation Graduate Design Studio I	3
Digital Viscom I	3
Analytical Drawing & Rendering I	3
Graduate Seminar	3
Studio Elective	3
MA Final Project	3
Digital Viscom II	3
Graduate Research Methods	3
Analytical Drawing & Rendering II	3
Professional Practice	3

The program is overseen by professors who are experienced practitioners and leaders in the design business who have succeeded in the field or who are presently doing so. Because creative genius and execution abilities alone do not ensure career development or entrepreneurial success, students also learn how to be professionals in addition to developing their critical thinking and strategic design skills. Students are taught how to work well in teams as peers and leaders. The actual pressures of deadlines and uncertainties — both those under their control and those beyond it — are managed by them. Through formal presentations and demanding critiques given by professionals in the field who can identify and hire talented individuals, they learn to champion their ideas.

3D modelling tools are parts of education, digital Viscom has 3d modelling applications from Alias to Zbrush and also includes Vred Keyshot in the visualisation area.

3.2.1.2.3. *Master of Fine Arts, Transportation Design;*

Table 8 - CCS Transportation Design Master of Fine Arts program's Schedule (Source: CCS, 2022)

1. year	Credit	2. year	Credit
Transportation Graduate Studio I	3	Written Thesis	3
Digital Viscom I	3	Transportation Graduate Studio III	3
Analytical Drawing & Rendering I	3	Graduate Thesis I	6
Graduate Seminar I	3	Studio Elective	3
Studio Elective	3	Transportation Graduate Studio IV	3
Transportation Graduate Studio II	3	Graduate Thesis II	6
Digital Viscom II	3	Professional Practice II	3
Analytical Drawing & Rendering II	3	Studio Elective	3
Graduate Research Methods	3		
Professional Practice I	3		

The MFA program is more productivity and expertise oriented. Here, with the extra one year added, it is designed so that the designer can specialise and get together more with professionals.

3.2.1.2.4. *Course, Dunning Automotive Design Pre-College Summer Scholarship*

Fifteen high school students get the chance to participate in CCS's summer Pre-College Automotive Design program. Faculty from CCS instruct the college's automotive design course, which collaborates closely with GM, Ford, and Stellantis designers and sculptors.

3.2.1.2.5. Course, Professional Automotive Modelling

This certificate program is for adults. two options are given. One is clay modelling and the other is digital modelling - Alias. These two areas were opened to meet the operator designer needs of companies in the sector. People who have not received training in this field in higher education can also do this operator job with the certificate program.

3.2.1.2.6. Clay modelling

For OEMs to previsualize automobile designs in 3D before going into production, clay modelling is a crucial ability. Students will develop their clay modelling skills while building a speed form throughout the first semester. Students will continue honing their abilities by making a clay model in 1/4th size from orthographic drawings of a production car. Students will concentrate on clay sculpting artistry throughout the second semester, interpreting vehicle design designs from the CCS Transportation Design department.

3.2.1.2.7. Alias 3D modelling

OEMs require digital sculptors with the ability to create maths data files for production. Working at a high level in Alias and having the capacity to handle structural and design problems are requirements for this. Sculptors must work closely with designers and engineers since they are the final link between the creative and manufacturing processes.

In addition to CCS's three undergraduate and graduate formal education, course programs according to the needs of both children and professionals are explained above. As a general point, it can be seen that, there are programs that meet the needs of the sector. An example of this is that there are course programs in areas with operator gaps such as clay modelling and Alias 3d modelling. It is seen that the point where the designer meets with the engineers is mentioned more than the other schools.

It is an exemplary institution of Lifelong education type. It appeals to both children and people of all ages with its post-graduate certificate programs. This is very valuable

for the expansion of the field of transportation design.



Figure 24. CCS Lifelong education (Source: CCS, 2023)

3.2.1.3. Istituto D'Arte Applicata e Design (IAAD):

IAAD is one of the well-established design institutes in Europe as a forty-year-old institution. It is the first institution to open a bodywork architecture program, which is the ancestor of transportation design, in Italy. It has a campus in Bologna as well as in Turin, the European capital of automotive design.

It is an institution with strong sectoral ties like CCS. An institute that manages job applications in the field they want with a career office for students and aims to fill the gaps in the sector with its students. Industry cooperations are given importance. It is a place where professional participants and students in studio projects adapt to professional life quickly and reveal their passion for design.



Figure 25. IAAD Torino and President of transportation design Giorgetto Giugiaro (Source: Auto Design Magazine, 2016)

3.2.1.3.1. Bachelor's Degree, Transportation Design

Table 9 - IAAD Transportation Design Undergraduate program's Schedule (Source: IAAD, 2022)

1st year	credits	2nd year	credits	3rd year	credits
Design history	4	Moto & Scooter	4	Moto & Scooter	2
Morphology	4	Interior design	4	Interior design	4
3D introduction	4	Exterior design	4	Exterior design	4
Basic design	4	Photo Sketch	4	Semiotics	4
Geometry	4	Modelling and rendering	2	Marketing	4
Theory of perception	4	Production Tech	4	Modelling and rendering	4
Italian language	2	Colour & Trim	4	Moto & Scooter	2
Design history	4	Mobility design	4	Interior design	4
Alias	5	BYT	4	Exterior design	4

Basic design	4	Exterior design	4	Modelling and rendering	4
Physics for design	4	Interior design	4	Portfolio	4
Digital sketching	4	Modelling and rendering	2	Project work/ Internship	9
Morphology	4	Illustration	4	Thesis	5
Sociology of design	4	Ergonomics	4		
Italian	2	Product life-cycle evaluation	4		
		History and criticism of design	4		

Transportation design higher education program is the flagship program of the institute. Istituto D'Arte Applicata e Design in the three-year higher education program offers a curriculum that meets most of the sectoral needs. Here, many areas have been touched on, from the Alias 3d modelling program to the colour & trim lesson, from the ergonomics lesson to the exterior-interior lesson.

To increase the mobility of a transportation design graduate, 2-wheeled vehicles and BYT lessons that free the imagination have been added.

The product life cycle evaluation, production technologies and marketing courses added to raise awareness about the progressing processes in automotive design offices will also provide a great convenience in understanding the reasons for in-company needs in professional life.

Other schools have embedded in other courses; By giving geometry, morphology, physics for design, theory of perception and sociology courses in the first year, the education was started by gaining students' awareness of vehicle design in multiple fields.

3.2.1.3.2. Master Program, Transportation Design,

Table 10 - IAAD Transportation Design Graduate Program's Schedule (Source: IAAD, 2022)

PRELIMINARY MODULE	A U T O M O T I V E & INTERACTION DESIGN
History of vehicle design	Marketing
Design Sketching	Exterior Design
Illustration	Interior Design
Digital sketching	3D Digital Modelling
Car architecture and aerodynamics	Presentation techniques
Motorbike architecture and ergonomics	Portfolio
3D Modelling	UX/UI Design for Transportation & Mobility - UXTRD
Transportation Design - Motorcycles	MOTORCYCLES & PERSONAL MOBILITY
Transportation Design - Car Exteriors	Marketing
	Motorbike Design
	Bicycle and personal vehicles design
	Scooter Design
	3D Digital Modelling (Alias 2)
	Presentation techniques
	Sustainable mobility
	Portfolio
	3D Digital Modelling (Maya)

The IAAD Transportation design program is divided into two main modules. The first one is the Preliminary module which has a six-month duration. The second module has two options for students. One is for automotive & interaction design, the other one is for motorcycles & personal mobility.

IAAD is the first university which specialised in transportation design at the university level. This organisation's top education level is the master's program in transportation design. Even motorcycle design is another master program module in IAAD. There are even other detailed programs at the side of that. Technical courses such as vehicle

design history, car architecture and aerodynamics, motorbike architecture and ergonomics show that the first phase is the learning phase. As seen above, in the preliminary phase, the discover and explore parts were processed according to the double diamond diagram. technical knowledge has been increased and ties with the past have been established.

When it is switched to two modules, automotive and motorbike, which are the main modules, there can be seen that the main variable motorbike is a module that covers the whole two-wheel family, while automotive is about four-wheel vehicles and mobility. There is a traditional bicycle sub-course added next to the motorcycle, as well as the indispensable scooter sub-course of today. In addition to these, a distinctive point is that there is a 3d digital modelling course with three modules. However, in the main modules, the automotive module preferred the Alias as it is used in the sector, while the motorcycle module preferred the use of yeast.

The IAAD is like a mix of IED and CCS. It differs from other institutions on the list. Because the theoretical education of IED includes design and design philosophy grafting points. In addition, courses are positioned according to the needs of the industry, such as CCS, or according to the one-to-one job descriptions of the studios.

IAAD, which includes areas such as UX design, portfolio design, marketing and motorcycle design, which is not seen under transportation design in most schools. This enables students to experience most of the fields they may encounter in the automotive sector in their education life.

Industry cooperations of IAAD and similar elite design schools are advanced. For this reason, the proof of the success of the students in front of the media has also been facilitated. Turin-based design centres such as Pininfarina and Ital Design organise competitions open only to the students at these elite schools. It also launches the projects that are in the ranking to the media and has some of them made prototypes as they can represent the vision of the future. With similar activities, students have the chance to announce their success to the world quickly.

An example of this is the workshop opened by Pininfarina in 2016. On Board Emotions showcases the results of a workshop with students from four top design schools, who sought to create vehicles that looked at the future of the car, incorporating on-board emotions and how the car's interior may one day interact with the outside world. The schools involved are Istituto D'Arte Applicata e Design (IAAD) and Istituto Europeo di Design (IED) in Italy, l'Institut Supérieur de Design Rubika (ISDR) in France and UMEA Institute of Design (UID) in Sweden (Autocar Professional, 2016).

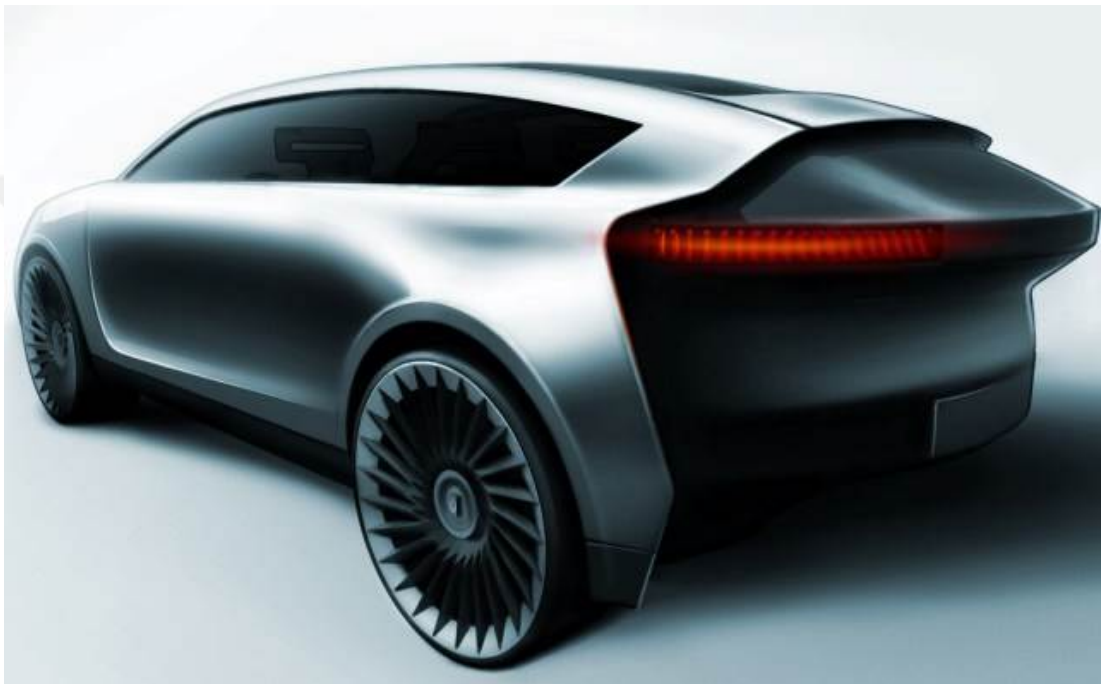


Figure 26. Product of IAAD students, the Molly from Pininfarina Exhibition, 2016 (Source: IAAD, 2016)

3.2.1.4. Poli Design;

Poli Design is planned as the branch of Poli Tecnico with connections to professional life. The institution also meets its spatial workshop needs from Poli Tecnico. There are interlocking ties. In addition, course schedules and studio participants are available, consider the needs of the sector.

Academic ties are weak compared to Poli Tecnico, but there are advantages in design mental gymnastics and excessive design practice. It is foreseen that the theoretical education of the design has been completed by Poli Tecnico, and it is now aimed to

increase the application practices of the design.

3.2.1.4.1. *Master Program, Transportation & Automobile Design*

Table 11 – Poli Design Transportation & Automotive Design Graduate program's Didactic curriculum (Source: Poli Design, 2022)

Car Design Studio
Exterior Car Design
Interior Design Studio
Alias modelling for Car Design
Car Design Culture
Transportation Design Workshops
Multimedia Tools for Car Design
Adobe Tools
Vehicles Architecture
Experience Interaction Design for Vehicles
Colour & Trim
Ergonomics
Presentation Techniques for Car Design
Creative Group Empowerment
Portfolio Empowerment
IP law in Automotive Design
Internship or Project Enhancement Studio

It is the only institution in the list with automobile design in its name. The reason for this is the only program on the list that specialises in this area. Inside the IAAD, the motorcycle is in visible modules. Or there may be yacht program contents in the IED undergraduate program. Here, on the other hand, since Poli design has a separate master's program for aviation, a separate program for yachts, a separate program for UI design, and so on, transportation design and automobile design remained a detailed program on their own.

3.2.1.5. Pforzheim University

Founded in 1877 as Ducal School of Craft, it started as an ‘educational laboratory’ of crafts, industrialized production and trade. It’s a public university. Interland transdisciplinary cooperation with both international institutes and design-studios as well as with recognized industry partners will provide a critical, blending insight.

Pforzheim is a city in the German state of Baden-Württemberg, which is one of the most progressive and globally connected regions of Europe. It is situated between the towns of Stuttgart and Karlsruhe. Numerous well-known multinational cooperation, including Daimler, Porsche, Bosch, and SAP, as well as strong small and medium-sized businesses, have their headquarters in this part of Southern Germany.

Pforzheim University imparts commercial skills rather than merely theoretical knowledge because of its applied mission. The instructors have at least three years of professional experience in addition to their doctoral or master's degrees. Research and professional experience are both used as the foundation for the instruction.

Speaking of instruction, exploit the opportunities provided by the local businesses to the advantage of both the students and the businesses.

Companies in the region
(selection)



Figure 27. The close location of Pforzheim University and industry (Source: Pforzheim, 2023)

3.2.1.5.1. Bachelor's Degree, Transportation Design,

Table 12 - Pforzheim Transportation Design Bachelor program's Didactic curriculum (Source: Pforzheim, 2023)

List of subjects
Project work (major subject)
CAD/CAS (computer modelling and image generation (rendering))
General model making and clay model making
Representation techniques (rendering, drawing, Photoshop rendering)
General design theory and automotive design theory
Ergonomics
Aerodynamics
Marketing
Design history and automotive design history
Colour & Trim

Students of the BA in Transportations Design are trained for professional entry into the position of junior designer in the automotive industry and adjacent or related sectors. Most of the students are later employed in the automotive industry (Pforzheim University, 2023).

- **Master Program, Transportation Design**

Table 13 - Pforzheim Transportation Design Master program's curriculum (Source: Pforzheim, 2023)

1. semester	Credits	2. semester	Credits	3. semester	Credits
Advanced Tech, ergonomics	5	Presentation Techniques Virtual	6	Master Thesis	30
Design Management	6	Interior Design Project concept and process	10		
Exterior Design project concept and process	8	Colour + Trim	2		
Presentation Techniques 2D	2	Interior Modelling, Form Analysis 3D	4		
Exterior Modelling, Form Analysis 3D	4	3D Modelling	4		
3D Modelling	4	CA Material Simulation	5		

In contrast to graduates of the Bachelor course, the Master of Arts in Transportation Design fulfils the necessary requirements to structure a project team, to plan a design project and to supervise its execution.



Figure 28. ID student Lukas Wenzhöfer's winner project of the Opel Design Hack contest (Source: Pforzheim, 2023)

3.2.2. Course Details

Courses were selected based on the criteria of course content, including ergonomics, materials, aerodynamics, automotive design history, colour, and modelling software. These courses were also utilized in the matrix to narrow down the selection to five institutes.

Ergonomics, a vital aspect of vehicle interior packaging, is offered as a course at IAAD, Poli Design, and Pforzheim. Human ergonomics serves as a reference point in interior design and surface modelling. An essential characteristic of Industrial Design and its sub-branches is their focus on human-centred design. While ergonomics is commonly included in industrial design education, the fact that it is not a separate course in automotive education highlights the significance given to this subject.

Aerodynamic knowledge is evaluated in the logic of vehicle exterior design and in the modelling of exterior A-class surfaces. A-class surface studies are conducted in programs like Alias, with aero virtual analyses performed at specific milestones and the design revised based on the outputs. Therefore, a designer's understanding of aerodynamics is highly beneficial to the process. Similarly, to ergonomics, IAAD, Poli Design, and Pforzheim offer courses in aerodynamics.

All institutes include courses on Colour & Trim. CCS combines material courses with manufacturing content with the exception of CCS. Some institutes provide material content in separate courses, while others include it within the Colour & Trim course. Knowledge of colour usage is crucial for those working in the colour and trim field.

The material course is exclusively offered at the undergraduate level at IED and Poli Design. This course equips designers with an understanding of production methods and materials to realize their designs. Knowing the available production capabilities is essential, particularly for interior component designs, allowing the designer to keep a wide perspective and achieve the maximum suitable for the design.

History and Alias modelling courses are available in all programs except for CSS master programs and IED sketching courses. This indicates that educational institutions value design history and Alias modelling. Alias is a surface modelling program widely used in the industry. It is interesting to note that every school provides training for Alias modelers, a sub-branch within automotive design offices, while courses that colour and trim designers or sketchers can refer to are not common in every institute. This highlights the significance placed on Alias surface modelling.

3.2.3. Human Resources

Academic personnel are crucial for the development of students. Consequently, each of the five institutions has ensured that their academic staff is recruited in such a way as to assist students in establishing a network upon graduation. Furthermore, this teaching staff is supported by part-time teachers who work within the relevant industry. In order to ensure that industry-university cooperation projects are compatible with both academic and professional life within the university institution, professional designers from the company that gave the project are brought in specifically for studio courses.

The IED program brochures identify the companies in which the academic staff work. Similarly, these brochures also detail companies with which students have worked on projects prior to graduation, as well as those at which students have found subsequent employment. This underlines the importance of company connections for students.

Academicians play a significant role in facilitating students' entry into the professional sphere and providing them with work experience opportunities. At IED, almost all professors have backgrounds in automotive design studios or are currently still involved in the field. Despite having extensive academic experience, they retain close industry links.

CCS is a university with a particular focus on transportation design. Its faculty members have been drawn from Detroit design studios; some of whom remain active in the studios whilst simultaneously teaching at the university. For studio briefs and projects, OEM (original equipment manufacturer) projects are typically selected. Part-time lecturers from these companies are then appointed to assist designers with these projects.

One of the exceptional qualities of IAAD is the calibre of its lecturers and their dedication to professionalism and compassion. The faculty is composed of experts who operate within both the national and international "design system," alongside visiting professors. For instance, Giorgetto Giugiaro, the department president, was named Car Designer of the 20th Century. Meanwhile, Luca Borgogno works as a strategic director at Pininfarina. All lecturers have extensive industry networks at IAAD, and they regularly invite renowned experts to lead courses, seminars, and discussions to guide students throughout their academic journeys.

The academic staff members at Poli Design typically have backgrounds in academia. A significant proportion of the faculty has been recruited from Poli Tecnico, which distinguishes it from other institutions.

To illustrate how the automotive industry can inspire designers in other fields, consider the example of Walter de Silva. After working for the Fiat design studio in 1972, he subsequently moved to the Rodolfo Bonetto design office. Here he engaged in designing both vehicle interiors and products. Eventually, De Silva became the chief designer at Fiat Centro di Stile before moving to the Volkswagen group, where he designed some of his most memorable products. His trajectory highlights the interconnectedness between automotive designing studios and other areas of design and demonstrates how they can attract talent from other sub-disciplines. Even in his

retirement, he continues to design shoes in his own design company. This highlights how automotive design studios and institutions can recruit design professionals from various sub-disciplines. (Auto Design Magazine, 2023)

Lastly, it is worth noting that Pforzheim operates similarly to IAAD and CCS insofar as its professors are required to have at least three years of professional experience in addition to their academic credentials. This allows for a combination of academia and professional experience in teaching.

3.2.4. University-Industry Cooperation Types

University-industry cooperation enables students to gain exposure to the sector while they are still undergoing their education. This collaboration not only allows design offices within the industry to stay informed about new research through the university, but also enables the university to remain up to date with the industry (see Figure 29). Simultaneously, design offices can delegate projects to student designers within universities, thereby fulfilling their design needs that may have otherwise gone unmet due to various reasons.

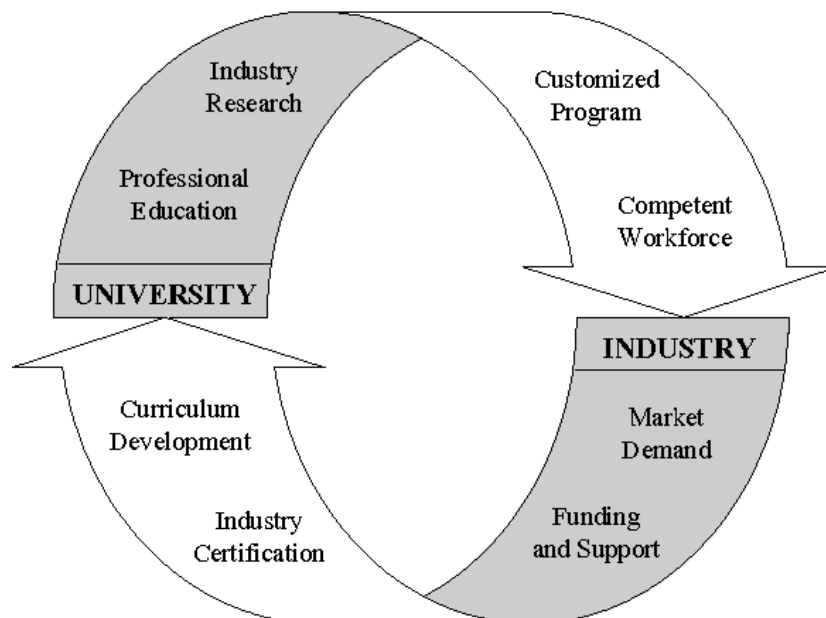


Figure 29. University - Industry Cooperation (Source: Research Gate, 2023)

IED has established numerous formal collaborations with various industries. These partnerships provide students with the opportunity to engage in studio projects

alongside professionals from these industries. The institute also offers internships and competition options to further enhance students' practical experience.

The Transportation Design Program at Istituto Europeo di Design S.p.A. (IED) is situated in Turin, strategically located in close proximity to renowned design offices such as Bertone, Ital Design Pininfarina, and prominent production and design centres like Maserati and Fiat. This advantageous location facilitates seamless collaborations between students and industry partners through internships and project engagements.

IED supports students through its Italy Career Service, which ensures a well-rounded exposure to the sector throughout the three-year education program, allowing for increased industry connections, including the final year graduation project. Individual mentorship support and career fairs organized by the school further amplify students' opportunities to interact with professionals. IED has established partnerships with automotive OEMs, TIER 1 and TIER 2 industries, as well as globally recognized companies in the furniture, fashion, energy, and technology sectors.

College for Creative Studies (CCS), an esteemed design school in Detroit, boasts substantial support from major automotive companies such as the General Motors foundation, demonstrating the strength of the institution's industry connections. Utilizing an old GM factory for its facilities, CCS leverages the partnership with the automotive industry to offer students design contests, internships, and sponsored projects, providing opportunities for new concept ideas and collaboration with automotive manufacturers and suppliers.

CCS incorporates brief projects from OEMs into all of its studio courses, allowing students to receive project guidelines and feedback from responsible designers. The college also holds Friday Design Parties, bringing together OEM designers, academicians, and students, providing a platform for students to showcase their projects. The Career Development Office at CCS assists students in preparing for life after graduation, offering guidance on resume and CV creation, cover letters, interviews, and job-searching tactics.

IAAD collaborated closely with design work on the project. Partner companies enable students to apply their knowledge in an environment closely resembling the

professional field they will enter. The institute upholds a classical master-apprentice education and working style, with opportunities for students to intern and engage in projects under the guidance of Giorgetto Giugiaro and his design studio. Furthermore, since 2008, IAAD has been bestowed the honour of being named after Andrea Pininfarina.

Through its extensive network of connections, IAAD creates opportunities for its top graduates to be recognized by prominent companies. As a result, students become part of a thriving design community with excellent employment prospects. IAAD maintains a database of over 5,000 businesses that collaborate with the Job Placement Office to identify young designers for potential employment opportunities.

The competition also provides the opportunity to be accepted to the school. here is an example of a competition run jointly by IAAD and IVECO. IAAD. promotes an international design contest in order to offer scholarships for international students interested in attending the undergraduate programme held in Turin in Transportation design. The aim of this collaboration IAAD - IVECO is to highlight the next future together with young talents focusing on the Iveco Group and electric truck world.

POLI Design is a subsidiary of Poli Techino, establishing closer connections with the industry. Students at POLI have the opportunity to undertake their graduation projects with OEM connections.

Another notable institution is Pforzheim, which capitalizes on its advantageous location. Stuttgart, known as one of Germany's automotive cities, serves as the connection point between automobile manufacturers, suppliers, and the academic world.

Both the educators' close ties to the industry and the students' career offices ensure a strong integration of year-end exhibitions and graduation thesis projects with the professional world, fostering industry-university cooperation.

In this theses five institutes' transportation design programs are compared, there appear to be minimal macro differences. The sectoral approaches taken by CCS and IAAD, as well as the operational principles of the student career offices, exhibit

striking similarities. Theoretical education philosophies at IED, IAAD, and Poli Design are compatible, aligning closely in terms of internships and involvement of professionals in studio projects. There is, however, one academic distinction. Poli Design, as a subsidiary of Poli Tecnico, stands out as a separate institution established by three different institutes. This indicates that Poli maintains an academic affiliation with Poli Tecnico while remaining more industry oriented. No similar affiliation with public institutions was observed in the case of CCS, IED, and IAAD. It is worth noting that Poli Tecnico encompasses the general branch of industrial design, while Poli Design specializes in transportation design, forging strong connections with the sector.

With IED and CCS offering undergraduate, postgraduate, and master's programs across multiple campuses, this field of study is accessible to a diverse range of individuals. The main focal point remains Turin, renowned for its concentration of automotive design offices and higher education institutions.

3.2.5. Comparison of Five Selected Transportation Design Education Institutions

The reasons for choosing the five institutions 3.1. transmitted by matrix. In this section, the results will be compared.

The common points of the five institutions are that they are close to the university industry cooperation, the producers in terms of location, that they generally respond to the course branches that the sector needs, and that they are among the elite institutions in the sector and in the field of education.

In addition to these, it is a difference that CCS branches in history lessons as the representative of American culture. It is a difference that Turin institutes such as IAAD, IED, Poli Design open scholarship competitions with the support of local manufacturers. In addition, the design and concept competitions organized by local companies for the students at this institutes are also unique. Pforzheim of Germany combined all these differences with the German university and the Bauhaus culture.

While some institutions (IED, IAAD) open a special subgroup for 2-wheelers, others open a separate program for Colour and Trim or UI - HMI design (CCS). Generally Interior & Exterior design studios are separated but IAAD has an individual interior design master program besides of transportation education.



CHAPTER 4: PERSPECTIVE UNIVERSITY-INDUSTRY COOPERATIONS OF TURKEY AND T.R.N.C.

The industrial design department, which is the upper framework of the transportation design program, was established in Turkey in 1971 by the Istanbul State Fine Arts Department Academy and Middle East Technology University was opened in the same year. As the world brought industrial design to life with the industrial revolution, it takes the 70s to see the arrival of industrialization in Turkey and its reflection in higher education. For this reason, the sub-branches of the industrial design departments are still trying to create their sub-branches in the 2020s.

Most of the industrial design departments in Turkey are based on fine arts faculties. This has caused industrial design to fall under more art. Ties of the higher education program with the sector remaining weak. Today, industrial design programs can be seen under various faculties. However, there is no automotive design program or department with content in Turkey and north Cyprus.

4.1. University-Industry Cooperation examples for Turkey

Turkey is recognized as one of the world's largest manufacturing nations. However, its focus on design is not prominent, leading to its classification as an assembly country. As a result, there is a lack of corporate universities and industry collaborations. The initial policy document that marked the beginning of university-industry cooperation is the "Turkish Science Policy: 1983-2003." This document is distinguished by its emphasis on enhancing research and development (R&D) activities within the country and its identification of priority areas (Kiper, 2010).

4.1.1. Automotive Industry collaborated – Higher Education Examples in Turkey's Perspective

Among the examples of institutions that exemplify this cooperation are Konya Food and Agriculture University / Konya Şeker, OSTIM University, TOBB University, and GUNSEL Academy.

4.1.1.1. Konya Şeker,

Turkey is a productive agricultural country. Konya Şeker is a farmer's cooperative which is an agricultural industrial giant in Turkey. This cooperative has established Turkey's first specialised university in agriculture and food; Konya Food and Agriculture University.



Figure 30. Konya Şeker (Source: Konya Şeker, 2023)

Konya Şeker founded Konya Food and Agriculture University. With the support of this cooperative-based structure, the university provides the best opportunities to its students, while offering them the opportunity to receive education in a real university-industry cooperation environment with 45 facilities and gain serious experience before they graduate (Timeturk, 2020).

Konya Şeker is a major corporation in the chocolate and bakery industry hailing from Anatolia. It is owned by some big cooperations based in Konya. They have even produced their seeds, and fertilised and fed themselves until the end item which comes to our tables. Because of that they are in several fields of agriculture and production. They need several types of human resources and knowledge. These needs have created the bases of the Konya Food and Agriculture University.

To meet the needs of the farmer and the producing Konya population; It provides education in many fields from interior architecture up to the Genetics and Life

Sciences Program, from Herbal Production and Technologies to the Molecular Biology and Genetics or engineering branches.

In addition to formal undergraduate education, number of certificate programs and training are provided in the field and in-house for the training of the regional farmer. In addition, higher school programs are also evaluated to develop technical staff.

4.1.1.2. OSTIM Technical University,

OSTIM Technical University is the first industrial university in Turkey. OSTIM organised industry is the heart of manufacturing in Ankara. There are lots of different fields to study there and with the human resources and academic research needs, OSTIM Technical University has burned.



Figure 31. OSTIM Technical University and OSTIM organized industrial region (Source: OSTIM University, 2023)

Looking at the words of the Chairman, Board of Trustees, OSTIM Technical University, ORHAN AYDIN;

“OSTIM Technical University's education and training approach is to establish an ecosystem to strengthen the courage of entrepreneurship and design experience and to lead to discovering the potential of our students, academicians, entrepreneurs,

employees and all social groups interacting with OSTİM. Our board of trustees, consisting of experienced people in the business and academic world, will expand and develop the current innovative and entrepreneurial learning environment through national and international academic and economic cooperation networks.”

As Mr. Aydin stated, one of the main subjects of the university-affiliated with this industrial establishment is a working life ecosystem included in student life. Here, it is aimed to be intertwined with professionals and to experience the projects in the industry even during their education life.

OSTİM takes an active role in the industrialization of the region. To meet the future needs of the industry, it carries out activities such as education, employment, research and development, innovation, technology transfer, and entrepreneurship, in cooperation with the university - industry. It is effective in increasing the science and technology competence of the country. OSTİM does this with companies within the industrial zone as well as with foreign companies. In addition, the OSTİM industrial establishment expanded its network in the field by making industry-university cooperations with many universities such as METU before the establishment of this university.

OSTİM Technical University Rector Prof. As Murat Yulek narrates; This university has 200 thousand blue- and white-collar industrial workers; It is located at the very centre of a large industrial basin, which was established with the efforts of workers, businessmen and entrepreneurs. Therefore, it is the result of an effort and energy that is extremely rare in the world.” used the expressions (OSTİM,2019).

4.1.1.3. TOBB,

The similar but bigger association of OSTİM, TOBB has some similarities with OSTİM. It is owned by the Union of Chambers and Commodity Exchanges of Turkey. Leveraging the name of this umbrella union, the university actively collaborates with various industries, offering abundant human resources and conducting extensive research within them. Similar to OSTİM, TOBB extends its reach beyond Ankara,

encompassing multiple regions across Turkey. Consequently, its industry capabilities and diversity are highly advanced.

TOBB University was established by TOBB with the aim of nurturing individuals who can contribute to this advanced business network, possessing a broad perspective and productivity for the future. Unlike other universities in Turkey, it exclusively provides education in Turkish and has three academic terms per year. Moreover, the duration of internship programs and the integration of university projects with companies affiliated with TOBB organizations further bolster its industry connections.

4.1.1.4. Near East University / GUNSEL Academy,

GÜNSEL Academy reaches students in various ways. "My profession is in my hands" project for vocational high school students is in action. Job-guaranteed internship opportunities for those who are students at Vocational High School. Near East University provides job-guaranteed graduation opportunities for its engineering students.

GÜNSEL Academy, operating within the body of GÜNSEL, the electric car of the Mediterranean, has trained the young people who will establish the future of the automotive industry through the internship and training program "My Job Is in My Hands".

The "My Job is in My Hands" project includes all students who study at vocational high schools in the TRNC and who want to establish a future in their own country. Within the scope of the project, which aims to increase youth employment by transforming the country's youth into well-equipped and professional individuals, consisting of senior students from Vocational High Schools. The project schedule is the eight-month training and internship program and graduation. "GÜNSEL Academy Specialization Certificate" is conferred upon to students who participate in the project and successfully complete the program. All students who receive this document are entitled to a 100% scholarship if they start their education at the relevant vocational schools of Near East University. In addition, all students are supported with a monthly internship allowance.



Figure 32. GÜNSEL Academy first graduates (Source: GÜNSEL, 2023)

Experienced professionals of GÜNSEL also give theoretical and applied courses to the students at the Near East University Faculty of Engineering and the related departments of the Near East University Vocational School, which have internship and employment guarantee at GÜNSEL. In this context, courses such as "Applied Engineering Education", "CAD Design", "Vehicle Mechanics and Subsystems", "Drawing in Electrics-Electronics" and "Electric Vehicle Technologies" are given by engineers at the academy.



Figure 33. The interns have their lectures in the factory field and classes from the professionals (Source: GÜNSEL, 2023)

With these various applications, GÜNSEL Academy not only provides its own employment, but also increases its limited internship opportunity capacity in Northern

Cyprus. In addition, benefits are provided in the field of education by completing the formation of its own employees. GÜNSEL electric vehicles, which is a subsidiary of the university, can thus serve in two fields from education to industry.

4.1.2. Automotive Industry collaborated – Higher Education Examples in Turkey's Perspective

University-industry cooperation holds great value for students as it allows them to break free from the confines of their academic studies and gain an understanding of how their education applies in real-world contexts. Students excel in the research aspect, complementing the technical education they receive at school. They demonstrate the practical application of design in their studio projects, enabling them to experience the entire design process, from problem definition to solution. This mirrors the industry's approach to problem-solving through university-industry cooperations, internships, and similar programs, where students are exposed to potential solutions and can choose the most logical one to conclude the design process.

This research highlights that Turkey does not have dedicated higher education programs for transportation design, specifically about automotive design. However, there are industrial design programs at various levels that are relevant from Turkey's perspective. These programs typically include at least two summer internships, graduation projects in collaboration with companies, and academic guidance when needed for industry-related matters.

From a broader perspective, university-industry cooperation is believed to enhance both industrial productivity and educational effectiveness in universities. Integrating theory with practice accelerates the learning process and facilitates the transfer of knowledge to the field of production.

Universities play a vital role in fostering cooperation with the industry by leveraging the support of non-governmental organizations and trade associations, tailoring their collaboration to industry-specific skills and resources.

The industry, as a key player in this cooperation, receives support from the government and trade associations. It ensures the transfer of knowledge acquired by instructors and

students to the production processes, providing a practical application for the scientific knowledge gained in academic settings.

4.1.2.1. Hacettepe University, Automotive Engineering Program / Mercedes Benz Turk A.S.

Turkey's first Automotive Engineering Undergraduate Program established in 2005 under the umbrella of the Mechanical Engineering Department. While determining the curriculum of the courses in the faculty, it was inspired by engineering schools in America, Canada and Europe. Mercedes Benz Turk A.S. has been supporting the department since its inception. German foreign language preparatory courses were offered at the request of Mercedes Benz Turk A.S. The more the industry carries out its work with universities, the more positive its reflection on the industry will be.

In the establishment of the department, reference was taken from the Department of Automotive Engineering at the University of Esslingen. Before the establishment of the department, Mercedes factories in Germany and Turkey were visited and the needs of the sector were considered. The curriculum of the University of Esslingen and the link between it and the sector were observed.



Figure 34. Hacettepe Mechanical Engineering Department first automotive prototype (Source: Hacettepe University, 2023)

4.1.2.2. Uludağ University, Automotive Engineering Program/ TOFAŞ

Based on the Turin example, the first automobile factory of our country, like Fiat, is TOFAŞ, again with a FIAT licence. Bursa, where TOFAŞ is located, is the centre of most of the sub-industry and main industrial establishments of the country.

There are three universities in Bursa, two of which are state and the first is foundation. Bursa Technical University, Bursa Uludag University and Mudanya University. The aim of Mudanya University, which was opened in 2022, is to develop business-university cooperation in order to become an entrepreneurial university and to benefit students by developing sectoral cooperations (Mudanya, 2022). The goal of Bursa Technical University is as a university specialising in the field of "Robots and Intelligent Systems" by YÖK; To be among Turkey's Most Entrepreneurial and Innovative Universities (BTU, 2023).

Uludağ University is integrated with the automotive sector in the education process. Especially Automotive Engineering Department, this connection is used in several courses, academic research and R&D project.

Professionals in the sector contribute to the academy with opportunities such as training demand, internship and graduate request, and sharing experience in courses (USIGEM, 2021).

As there are successful examples of this in engineering, there are offices in Bursa that can apply it in the field of design. The way professionals participate in studios can be set up, as in the case of CCS.

Job opportunities are offered to graduates in and outside of Bursa, the industrial capital, by Uludağ University career application and research centre. This platform is in practice in many Universities, including Izmir University of Economics. However, if this is done in a location within the industry such as Bursa, the network can be established much faster and with minimum effort.

In Turin, the capital of Automotive design in Italy, there are more than sixteen institutions at the higher education level. There are three universities in Bursa, the automotive production capital of Turkey. The automotive sector is a sector with long-term R&D projects and needs long design research and concept studies for each project. For this reason, applications to TUBITAK projects are more common in our country than in the automotive sector. Consulting on projects of R&D units from universities is quite common. It is seen very often in association with the departments that run parallel to the sector, such as Uludağ automotive engineering.

This is expected to happen for automotive design as well. Improvements can be made to support this. It will be beneficial to increase the number of universities, to have campuses within factories such as Vestel - Özyeğin cooperation, to include designers from the sector in the formation of briefs and formal education processes in studio projects, as in the example of CCS.

With the ownership of this department, specialisation in automotive design, such as yachting, will become widespread in our country. The increase in domestic companies with brands such as TOGG, GÜNSEL and Amperino will ensure that the sector expands and that the design needs can be met by local designers.

Turkey has a production capacity of nearly 2 million commercial vehicles (AA 2019). Some of them are Turkish companies and some are foreign licensed assembly companies. Companies such as Anadolu Isuzu, Otokar, TemSA, Ford Otosan, Bozankaya provide significant employment by keeping their R&D offices and design offices here.

Due to the depreciation of the economy in our country, the number of accessible passenger vehicles has decreased. For this reason, micro-mobility solutions, which are subcategories, are becoming widespread in order to provide individual transportation for people. In this regard, companies such as Volta and Amperino, which are domestic companies, have L7 L6 class solutions. In addition, companies such as Piano and RKS prefer to bring vehicles from China and put them on the market. If the domestic design and domestic brand concept such as Amperino is preferred over the vehicles imported

from China, a basis can be formed for the spread of design and production in our country.



Figure 35. Amperino sketch by Sedat Öztürk Design Studio (Source: Amperino, 2023)

4.2. Short term - Mid Term - Long Term Vision

Terms of educational processes, it varies according to whether the effect of this process is desired to be seen in the short-term, medium-term or long-term. While making a vision analysis about a program that has not been opened before, it is necessary to proceed step by step to the future. By setting the vision of the program in the short, medium and long term, basic milestones can be set one by one for the program to be permanent.

4.2.1. Short Term

The vision is planned out to be implemented up to one year. The basic needs of a newly opened department can begin to be met in the first short term. The main elements of this are the need for students and instructors.

In terms of students, there can be professional designers who are actively working in the automotive industry and automotive design studios in our country. Sculptors, painting, and ceramics graduates are working as clay models. Automotive or mechanical engineering graduates can work as CAS models. Textile engineering or fashion graduates can work in the field of colour and material. Graphic design, visual

communication design, and animation graduates can work in the field of UI design. Industrial designers -who are the main characters in all of these subgroups- work intensively. This means that all professionals that can come from various fields and meet in a studio are transportation designers. Each person with these undergraduate levels can receive training in the main title of transportation design at the next level of expertise. In the short-term vision, the master's programme can be evaluated by taking from these departments.

Graduates of the master's programme can also enter the instructor cycle in the future and meet the academic staff needs in a limited period. And a fast-training process of a master's programme - instead of an undergraduate education programme long - for the needs is completed.

4.2.2. Mid Term

Mid Term vision is planned to be implemented within a span of one to five years. During this period, the sector's requirement for specific expertise has been fulfilled in the short term, paving the way for a broader educational framework to be developed. Undergraduate students can undergo more comprehensive training through the bachelor's degree programme within this five-year structure. As evident from the title 3.2.1. curricula, an elaborate education programme can be formulated with a bachelor's degree programme that offers an increased and diversified range of courses. Consequently, this will facilitate the attainment of a larger number of graduates and enhance the visibility of the department to the general public.

4.2.3. Long Term

This vision is planned to be implemented in five to ten years. Master program and undergraduate program graduates have become widespread in the sector over time, and as mentioned in the same CCS and many university examples, the contributions of the industry and network expansion in part-time teaching, and studio projects may have been provided. Thanks to this expanded network, it is now possible to expand the scope of undergraduate and graduate levels and become a faculty or an independent university by taking transportation design as the centre. Examples of this are CCS and

IAAD. In the case of Turkey, Istanbul Technical University (ITU) - Maritime Faculty can serve as an example. Starting its journey as a boarding school in 1884, it was first brought to the level of ITU high school. It was formed as a faculty in 1992. Ocean Engineering at Istanbul Technical University contributes significantly to Turkish marine technology. It is supported by many public and commercial organisations as well as business interests (OECD Council Working Party on Shipbuilding (WP6), 2011).

As in the examples of IED, CCS and IAAD, a wide range of student acquisition can be achieved with short and long-term courses as a plus.

In long-term planning, lifelong education can also be included. In today's world, corporate companies are establishing their academies and their employees are required to receive regular training. An example of this is TOFAS Academy. If corporate companies see this as a need, then students who graduate from the transportation design program can return to their faculties in the areas they are missing whenever they want, and they can repeat the course or participate in the course program.

4.3. Lifelong Education

As an output of these, location is very beneficial for educational institutions. Another area where location is important is lifelong education. As the years go by, the retirement age is getting higher, and the working life is getting longer. However, university education is not renewed. One of the ways to prevent this is lifelong education.

Lifelong learning is a form of self-initiated education that is focused on personal development. While there is no standardised definition of lifelong learning, it has generally been taken to refer to the learning that occurs outside of a formal educational institute, such as a school, university or corporate training (Valamis, 2022).

Designers who took the automotive design education required for the entrance ticket to the studios in their 20s have been working on this education for almost fifty years. However, if lifelong education is adopted by educational institutions, former graduates

can refresh their knowledge with collective events such as seminars and symposiums every ten years or as needed.

But is lifelong education meaningful in corporate work discipline. Can the institutional reflex make a logical framework for employees to return to universities periodically and spend time only on education? An example of this can be given from Turkey, again from the automotive industry. Many companies in Turkey do not only generate income with the production and sale of products, but also with training services. In particular, the automotive supply industry and main industry provide in-house and non-institutional sectoral training. An example of this is TOFAŞ Academy.



Figure 36. TOFAŞ Academy (Source: TOFAŞ, 2022)

TOFAŞ Academy provides in-house and sub-industry organisations under the main titles such as Behavioural Development Programs, R&D Development Programs, Occupational Safety School, Internal Trainer Development; It provides training in various fields such as Geometric Dimensioning and Tolerancing (GD&T), management training, mentoring training (TOFAS Akademi, 2023). Employees who

successfully pass these trainings can climb the career ladder. Thus, the company encourages its employees for training.

The organization also takes lecturers at the vocational high school level to courses within the institution. TOFAŞ Academy has its own laboratories in schools. There are chief instructors of these laboratories. Every year, sectoral innovations are conveyed to these instructors within TOFAŞ, and they create the opportunity to train their own students better. Graduates are evaluated by TOFAŞ.

A similar example can be given for Vestel, which is in a different sector. The Management Trainee (MT) program organised by Özyeğin University's Business Institute is being implemented for newly recruited employees at Vestel. One of the most important features that distinguish the education given by Özyeğin University faculty members and sectoral experts from its counterparts in Turkey is that those who successfully complete the program have the right to complete the missing courses of the Özyeğin University MBA program by attending the summer modules, thus obtaining an MBA diploma (Özyeğin, 2010). This partnership grew later, when Özyeğin University opened an R&D office on the Vestel City campus called the Technology Products Application and Research Center.

Considering the examples above, both educational institutions and corporate companies are trying to make education a part of employees' lives. Many companies provide financial privileges to their employees who have master's and doctoral degrees. This means that employees who are oriented towards self-development and research through education are desired. If this is the case, lifelong education can be supported, and its application areas can be expanded.

CHAPTER 5: PROPOSED MODEL

The primary focus of the thesis is the proposed model. Building upon the findings from the previous chapters, including theoretical research and questionnaire analysis, this model is formulated and put forth.

The main driving force behind the development of this model stems from the scarcity of automotive design graduates in both Northern Cyprus and Turkey, and the demand from automotive design studios to hire designers from industrial design backgrounds.

Consequently, the establishment of this model will not only address the sectoral gap for graduates but also facilitate the design of shorter and more aligned graduation programs that cater to the industry's needs.

Despite individuals entering the automotive sector with a foundation in industrial design education, they lack the requisite theoretical and practical support specifically in the realm of automotive design, which is the second part of the double diamond process. The proposed model seeks to bridge this gap. As a result, many recent graduates aspiring to work in this sector choose to pursue automotive design certificate programs or one-year master's programs offered by institutions like Domus Academy, Poli Tecnico di Torino, or IED to acquire the necessary skills and knowledge.

Double diamond is a visual understand the process of design. Double diamond was taken as reference for curriculum plan in the model setup of this thesis. Double diamond consists of 1 knot and 4 main processes. The double diamond shows the four steps of the process that lead to creativity by connecting four triangles (Figure 37). That illustrates the points where ideas converge and diverge along the journey in this way.

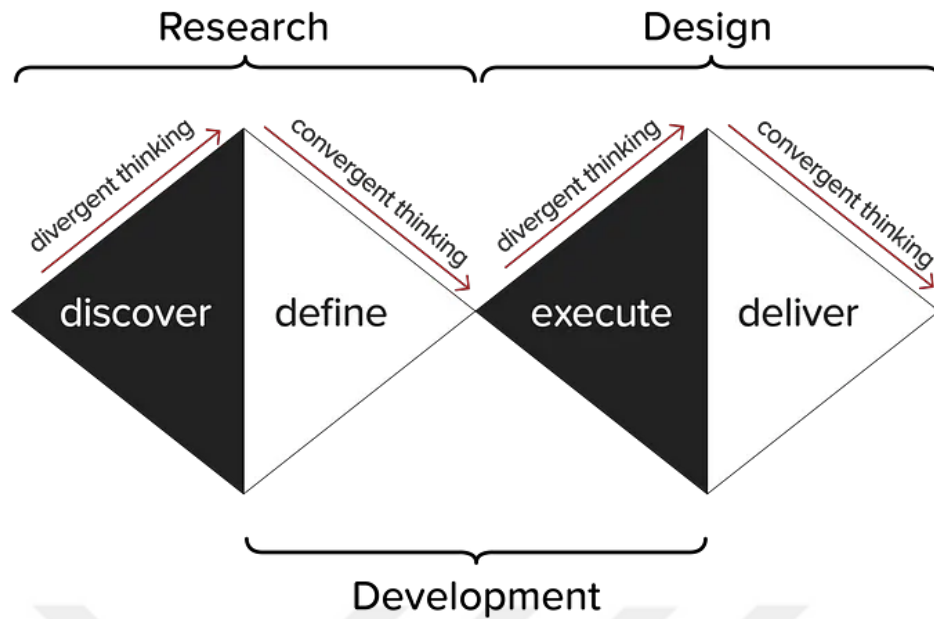


Figure 37. Double Diamond framework (Source: Stubbs creative, 2022)

Designers have successfully created designs while utilizing the minimum number of resources through our thought-driven approach.

The genuine value of the double diamond framework lies in its efficiency. It places value creation at the forefront, ensuring that earlier decisions do not veer too far from the optimal design paths (Stubbs, 2018).

This program proposal aims to enhance the discovery and defining abilities of participants in the field of automotive design. The practical skills of industrial design graduates currently employed in automotive design studios are highly refined. It can be inferred that the execution and delivery components of the double diamond method are acquired through professional experience in the business world.

5.1. Model explanation

In this thesis, the proposed model is planned with a short-term vision. This short-term education model is designed as a master's degree with a thesis.

The model study contains subgroups such as methodology and structure, requirements and admission procedures, curriculum, human resource needs, industry-university cooperation types, and facilities.

As described in the diagram below (Figure 38), the model takes inspiration from the double diamond framework. This method is considered the most practical and suitable approach for postgraduate education in automotive design in Turkey. This program is at the graduate level, it is assumed that students possess a fundamental understanding of design, upon which the program builds. The program commences with the discovery phase, involving theoretical courses to provide the technical boundaries and design philosophy of automobiles. In the second semester, the define phase is planned, which includes controlled practices such as clay modelling, user interface design ideology, computer-aided styling (CAS) model studios, and introductory exercises.

After the first year, the program enters the develop phase. Industry collaborations become crucial, and students are expected to make professional contributions to the design process leading up to their graduation project. In the framework academic and industry focused education contents can be seen in the chart. This approach allows students to prepare for the sector and demonstrate their abilities through the evolve phase after graduation. Collaborations begin with visits to exhibitions and technical trips. Subsequently, office work and the graduate project are initiated. The career office introduces a new understanding and opportunities through career coaches and events focused on career development. During these sessions, mentors and career coaches strive to understand the students' needs and focal points, creating a career plan. The career office aims to establish connections between studios and students at the end of the program.

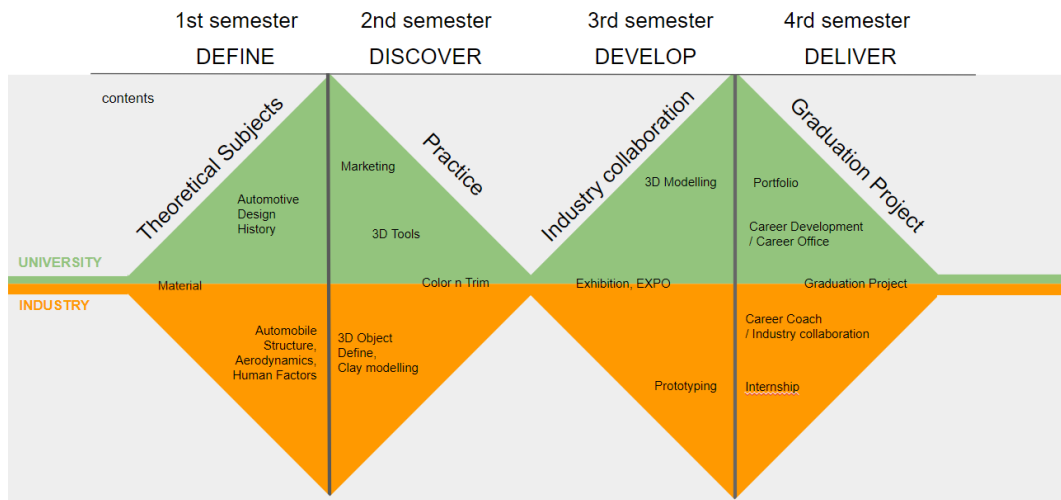


Figure 38. Model Diagram (Source: created by Author, 2023)

Currently, students arrive with prior experience in design offices at the undergraduate level. For this reason, gaining hands-on practice in addition to theoretical education has become increasingly essential.

To define participants' experiences from the previous semester and experiences, studio training which incorporates colour and material fundamentals, clay modelling, and prototyping can be integrated into the second-semester curriculum.

After the second semester, an opportunity can be provided for greater involvement with professionals through technical trips, participation in fairs, and the initiation of an integrated graduation project with design offices.

In the last semester, the career office's networking capabilities and students' portfolios can be tailored according to the job market's demands.

5.2. Methodology and Structure

A combination of theory and practice: all the projects and research, as a whole, look towards the future of the automotive industry.

This education model is planned from scratch on how project design and design thinking can be successfully applied to car design too. Get skills of technical and

application skills, software tools and talent on a variety of projects with ever increasing complexity. Earn knowledge of materials, aerodynamics, styling and ergonomics.

This programme will further develop the passion and specialise in the sector, working together with some of the key players, domestically and internationally. The main focus of the whole programme will be the dissertation project.

The goal is to provide an innovative approach to training. The best way to become a professional in transportation design is to be trained to learn from experts in the field. The design work was planned to be carried out in cooperation.

Partner companies allow students to put into practice what they study in an environment very similar to what they will encounter in the professional field. Making both the needs of partner companies and training objectives converge in projects creates a doubly favourable situation, aspiring designers have the opportunity to learn with industry leaders and these can monitor future talents to be included in their companies.

As specified in Chapter 2.2.2. Bursa is the capital of the Turkish automotive industry. The automotive industry is an industry led by the R&D department. This research not only based on the main industry, but suppliers also undertake the most innovative projects and present them to companies. The most common place for this is the global automotive supplier fairs, innovations are showcased in fairs such as foam expo, automotive interior expo, automotive plastics expo, automotive seating exhibition. Most of the fairs take place in Germany, which is one of the locomotives of the sector. Universities in the region participate in these fairs with their students. Industry professionals seek innovation on projects with suppliers. It is a complete incubation environment for network and information. It is very important for students in their educational journey to participate in this environment and evaluate possible opportunities.

One of the location advantages of Bursa is its close location to a world centre like Istanbul. Students' participation in fairs on a global scale and easy access to events such as Design Türkiye will provide convenience within a curriculum.

This system also allows students to simulate working conditions in a professional context: working with precise deadlines, correcting work in progress following customer feedback, and working in teams and objectives. During the education, great importance is planned to be given to presentations and design contests, students are encouraged to make presentations of their work, and supported in participating in international competitions.

In this process, professors are key figures who represent the link between academia and industry. All professors are planned to be professionals in their respective fields of teaching, they know the companies in the sector, and they know what young designers need to be competitive in the market. Students find in the Professors a valid reference to improve and understand which aspects of their professional skills must be refined to enter the world of work as main players.

This program proposal can be planned as built on a two-year plan as a short-term vision. Since the participants of the program will come from various fields of expertise, the beginning of the training can be planned as inclusive and instructive for everyone.

As examined in Chapter 3 in the schedule part, the IAAD example can be preferred for a start in Turkey when the admission requirements for the master's program of IAAD and the diversity of the applicants are taken into account. The division of IAAD into two divisions called the master module and preliminary module, followed by motorcycle and automotive design, may be too detailed for Turkey at the beginning. Graduates from here will enter a limited number of automotive design offices, and then they will enter the heavy vehicle or construction machinery sectors. For this reason, it is not necessary to go into detail.

The education of the first year can be theoretically based and the course contents that fill the general framework. That can be called discover – theoretical courses for first semester and define-practise for second semester. These courses: there may be instructive lessons in the classroom environment such as automobile architecture, aerodynamics, ergonomics, automotive design history.

As examined as define period, students can practise on clay modelling studio, UI studio. After the theoretical courses, expo visits and marketing courses help students for combine the theory and reel life together. 3D modelling courses starts from here for the better results on their studio projects.

In the second year, a CCS-like setup may occur, in which professionals are invited to the training program with briefs, among the academic staff. In CCS, the establishment of companies to be included in the school with the brief and studio designer can be applied here. The second year is entirely based on design, develop and deliver. This means that academic learning leaves its space to industry and practises step by step. The student is asked to present something. Content that the student can show himself can be put here. Clay modelling, Interior-exterior design prototypes or UI design mock-ups can be added to match the final project.

In order to increase the integration into the professional life here, office working hours can be created with the company matched for the graduation project. This will enable the student to be in the network for his/her graduation project and thesis, and to establish new channels for information flow. In this regard, it is very beneficial for the career office to provide the connection between the students of the department and the companies and match them with the right projects.

At the end of the two-year education plan, participants complete the graduation project and thesis. Here, they will have carried out a project with a company participating in the second year school studio. They will also have carried out office work and mock-up production with another company for the individual graduation projects and theses. Thus, students who have worked with a minimum of two companies in the last year of their graduation will end their education life with high sectoral gains.

5.3. Requirements and Admission Procedures

This program is designed as a graduate program. When the program is evaluated in terms of Turkey and North Cyprus, another example of automotive design will not have started education life yet. For this reason, acceptance conditions can be kept as

wide as possible and the acceptance of this profession in society can be accelerated and awareness can be raised.

As stated in the Methodology section, this program aims to establish a foundation in the field of automotive design in our country and to advance on it. Cause of that, each graduate is very valuable, and it is expected that they will be able to return to school in other roles in the future. Therefore, the master's program should have a thesis and graduates should be able to return to the school as educators in the future. As another possibility, they should be able to improve themselves with doctoral programs.

Designers can be transferred from all over the world to the automotive industry, which is an international sector. Firms are very rich in national diversity. Considering this, the language of education may be English so that someone who has grown up in Turkey can find their equivalent in the world. Of course, this is a need for finding educational resources and following the sector.

Students can customise their curricula by participating in contests, seminars, workshops or long-term internships to collect additional credits necessary.

An essential detail of any academic plan is the student. After designing the educational program and recruiting faculty, student recruitment becomes crucial. To get the most out of the transport program, students are need, but also graduates in relevant professions (Rose, 1967).

Due to the growing number of OEM R&D departments and transportation design studios in our country, there are also numerous industrial designers, painters, and mechanical or automotive engineers who specialize in their respective fields. These individuals can be considered for admission into a master's program focusing on academic specialization in the automotive field, in which they already work. In this regard, a portfolio submission requirement may be imposed to select only the most eligible candidates for the studios. Moreover, similar to most fine arts disciplines, an application exam can be conducted, including submission of a project.

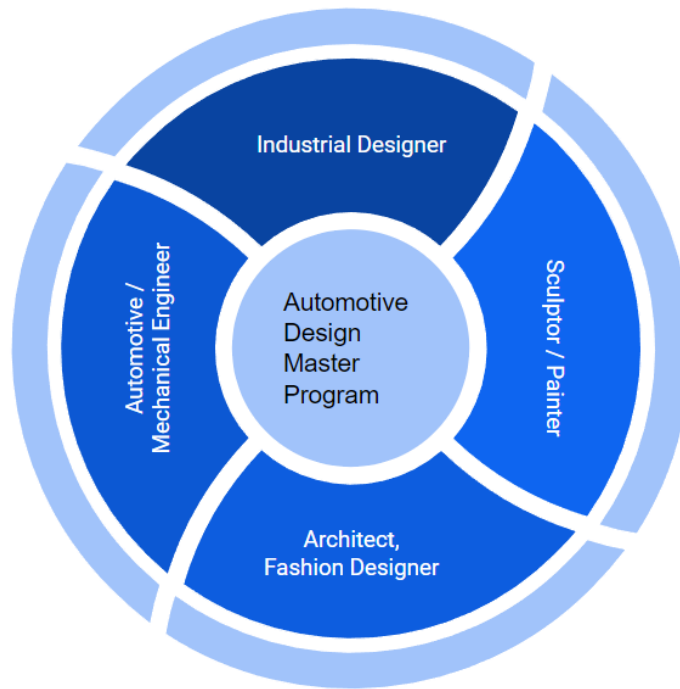


Figure 39. Automotive Design Master Program Target Backgrounds (Source: Created by Author, 2022)

Graduates in automotive design from other foreign institutes or those who have acquired substantial experience in transportation design or modelling are eligible to apply for direct admission to the master's module.

Admission to the course is in both cases possible only with the approval of the coordinator of the course based on the assessment of academic qualifications, professional resume and portfolio.

5.4. Curriculum

This proposal should be in line with the program objectives determined within the scope of the Turkish Higher Education Qualifications Framework. Similarly, ENTAK stated for industrial design, the Education program is the “Turkish Higher Education Qualifications Framework” It is clear that a similar one will be needed for the anticipated automotive design program.

The students gain the appropriate information, skills, and competencies, course syllabi with the relevant methodologies and evaluation criteria should be created to implement

the courses in the education plan and ensure that.

Table 14 - Didactic content proposal of the model (Source: Created by Author, 2023)

Vehicle design history
Car architecture // aerodynamics
Ergonomics
Colour & Trim Studio //material, trend analysis
Marketing
Clay Modelling Studio
Interior & Exterior Design Studio
UI Design // Kanzi and QT practise
3D Tools 1
3D Tools 2 // Autodesk Alias
Portfolio // Career Office // Network

The education plan should contain the required courses that will give the knowledge and skill structure for Design Theory and Methodologies and Design Technologies together with applied project (studio) courses. Organisations from corporate companies, the public sector, non-governmental organisations, etc. are used in design project courses. Giving initiatives that involve working with other stakeholders, the terms of which are established by protocols, is required. In addition to these, for familiarity with automotive design studios, clay modelling and VR studio, many of which are also in transportation design department studios, should be included.

As examined at Figure 38 information transfer can be made in the first semester with theoretical courses and discovery-oriented courses. Having theoretical courses such as vehicle design history, car architecture and ergonomics in the training program in the first year may be beneficial to close the gaps in this program, which can be attended from a large pool.

Whether it is an engineer or an industrial designer, the incoming student will have received some kind of 3d tools training (Table14). At the second semester, there may be various 3d tools training to be able to meet the students who participate in 2D design

fields such as visual communication design or graphic design in the same pot and to receive training on the industry's specialised Autodesk Alias program.

Except for A class surface, programs such as Blender or Autodesk fusion 360, which are preferred for faster results than the Alias, can also be transferred before Alias.

For colour and material, which is one of the building blocks of automotive design offices, there may be studio content that includes material lessons and trend analysis.

Participation in the fair is very important for this area, as the colour and material area are updated every year according to the trends, and there is a chance to make innovations in design every year with the improvement of the production capabilities of the suppliers. Fairs and speakers such as the German plastic components fair, automotive interior expo fair, and seat expo should be followed.

Clay modelling ability, which is used to put designs into practice, can also be provided in this section. Here, students can turn their imagined interior and exterior designs into reality with a clay model in scale and 1/1, prototype them and experience what they will encounter in the future.

In addition to the programs that provide practical solutions such as Figma for the UI&UX field, which is another building block and which is increasingly detailed, programs such as Kanzi and Qt that the automotive industry has to use can be transferred to university-level students. Through these programs, a bridge is established between software developers and designers. The better the designer's qt and Kanzi proficiency, the better he can show off his work. For this reason, a studio project can be carried out jointly with software developers and the designer can be introduced to this workflow.

According to Robson, it is obvious that the automotive industry should be doing more to pique consumers' attention by connecting the interior and exterior. Even while some manufacturers have made an effort to adopt a more uniform design philosophy, their efforts haven't made much of an impact on the field of car design. The importance and relevance of connecting the inside and exterior of cars is demonstrated by the deliberate efforts auto manufacturers are making in this regard (Robson, 2020). As it

can be understood from here, the interior is much more formed by packing the components and throwing the covering surfaces on them. In addition, the design is constrained by crash test regulations and ergonomic conformity. It is also aimed to be a whole with the exterior design. This greatly expands the scope of the interior. For this reason, when a student will be trained in interior design; It is necessary to make sure that it receives the information it will need, such as basic vehicle component information, ergonomics, the behaviour of materials, and vehicle regulatory requirements. Apart from this, the external design has to deal with other matters. The exterior design and character of the vehicle is the selling point of vehicle. For this, the exterior of the vehicle determines the whole identity. In order to do this effectively, the student has to be aware of marketing and sociology. In addition, the issues that limit the exterior design are certain standards such as pedestrian safety and basic lighting elements, and visibility.

Interior design and exterior design in automotive are designed with completely different design concerns. One has A class surface, and wide flowing surfaces, while the other has smaller components, short turns, different material diversity and material crushing margins. For this reason, the design, modelling and mock-up processes for 2 main design areas can be transferred to the student in one project. Ergonomic controls, which are indispensable for industrial design, are mock-ups that can be checked.

Students who follow design history, trends and fairs also need a marketing course to be able to read this flow. Here, students who learn to read customer reports can construct the future of design and the design language that responds to market needs.

In the "Develop and Deliver" section, the utilization of academic and industry connections can now be arranged. At this stage, students are encouraged to collaborate with career offices to select their graduation project and establish agreements with the design offices they prefer. This opportunity allows them to experience office environments, observe the progress of their projects, expand their professional network, and enhance their practical skills by incorporating prototyping processes.

5.5. Knowledge & Skills & Competence

In this thesis, a two-year master's education with the thesis is aimed as a plan. Students who have gained experience in automotive design studios have taken undergraduate mechanical-automotive engineering or come from education departments such as industrial design, painting, sculpture can participate in this model. The scope of the participants is varied, but each participant is expected to have a certain level of knowledge and skill at the end of this program. Graduates from this other branch working in studios are also expected to adapt quickly to basic design education. Upon graduation from this program, a qualified, target-oriented mass will be formed in the sector.

The participants from different various undergraduate are levelled in a certain level, it can be aimed to raise awareness at an equal level on some basic points. These are the subjects; ergonomics, materials, aerodynamics, 3d modelling tools and styling.

As an example, TOGG had used Pininfarina design from Turin to deliver the concept vehicle design. Pininfarina is selected because the design office background has a lot of automotive experience, and they design products of a certain standard. Firms such as Design-um or Hexagon studio are involved in automobile design projects. Unfortunately, they cannot accommodate as many designers as Pininfarina, which prevents project delivery in a short time. This means that if there are offices in our country where the number of designers and qualifications are formed, the design projects of domestic companies such as TOGG and GUNSEL can be outsourced in local studios.

It is aimed at helping the graduates of the program fill the gap needed in the automotive industry. To explain this gap; creative designers in the design office who are aware of production can read vehicle design trends, can give accurate feedback on the clay model process, and are familiar with limiting issues such as ergonomics and regulatory obligations.

Output of the program, the participating students are ready to work on the automotive and defence industry vehicles in Turkey and are expected to participate in the sector

with a vision. It is aimed to create a designer profile that can take part in every branch project in the design office and maintain coordination in project connections outside the department. Here, graduates are expected to contribute to the formation of a design office that shapes the goals of engineers or marketing teams.

Turkey is a country that has proven itself in the automotive engineering and assembly industry, but the place of design in the automotive industry has not yet settled on a global scale. One of the aims of this program is to contribute to the automotive design culture of our country and to lead the way in the creation of a unique Turkish automotive design language. Theoretical courses such as design history and marketing in the education program can form the basis for this development. It is essential for the sector to take the lead in this program and the automotive design in Turkey. With these positive developments, graduate students will quickly show their potential in the professional world.

5.6. *Human Resources*

Human resources can be named as structure of an automotive design education. The lecturer should be competent enough to maintain, evaluate and develop the program effectively.

As given in chapter 3, there can be seen in most of the automotive design-based training institutions; the lecturers can consist with expertise representing the sub-fields of product design, industrial design theory and methods and industrial design technologies. It has been observed that the academic staff have a background in the automotive sector or are still actively involved in the sector.

There are many automotive production factories in Turkey, some of them have design offices. In addition, there are design offices and main industries that make various vehicle designs such as tractors, construction equipment and defence industry vehicles.

There is also a highly experienced and wide-staffed industrial design academic human resources, considering that industrial design higher education has been in our country since 1971,

In the short-term vision, part-time professionals and full-time industrial design academic staff are a very good start for our country when the target is the master's program. Based on the frequently repeated reference courses in chapter 3, these cadres and course contents overlap.

In this way, the professionals and students can be in the same atmosphere. Similarly, CCS is a good example from Detroit.

Professionals need to take the basic training, such as formation, in order to enter the academy and teach. For example, basic formations such as the "internal trainer training" program implemented by GÜNSEL Academy. As a similar example, the training staff selected by TOFAŞ academy from its own employees can be shown. Employees who are experts in their fields go through a basic training process in order to be able to provide training, and then they can provide training in their own fields under TOFAŞ Academy. These trainings are given in the field of formation education in the education faculties of universities. Then comes the examination and certification process. A similar path can be drawn.

For full-time professors to carry out their academic studies, participation in scientific meetings, research funds, unpaid leave, etc. support and permissions can be provided. For example, participation in fairs such as the Automotive Interior Expo and the Automotive Plastic Expo in Germany, which is the centre of the supplier industry and material fairs followed by the automotive industry, should be made. These fairs and exhibitions are the areas where the most advanced points of the industry are presented. Bringing the academic world and the industry together in such global presentation areas will be beneficial for both the student and the lecturer. This is seen as a participant in the design and engineering departments of Germany's universities close to the fair.

5.7. *University - Industry Cooperation*

An educational institution such as CCS that survives with its sectoral ties and funds can be risky for Turkey. Because Turkey has the automotive main industry, which is at a very low level compared to America in terms of numbers and income levels.

As seen in the survey report in Arer's thesis; Most of the companies that carry out joint projects with universities are main industry companies (Arer, 2010). For this reason, this fact in our country can also be constructed for transportation design education.

The commitment of the sector to this program is important. Mechanical or automotive engineering is now available in almost every university in our country. In addition, there are engineers in every city and every factory in our city. however, this does not apply to industrial design. Unfortunately, the number of factories in need of design is very few, the number of graduates and employment numbers do not match each year. In order not to experience this example in automotive design, industry-university cooperation is important. Here, academia and industry would be connected together in three different ways.

In scenario one, companies will enter the studios with their own briefs and the participation of design studio staff at the end of the first year, where companies will be able to observe the abilities of the department and each student while they are still in the education process. This means that companies will be able to evaluate the potential here before the student even graduates.

Students can be worked together in studio projects that have ties with designers in the industry such as CCS. For example, in term studio projects, OEM requests can be observed, and a design studio staff can be brought to each lesson. However, the careers office can ensure that every student has an automotive designer mentor from automotive studios such as TOFAŞ R&D HMI Department, TOGG Design Studio, TemSA Industrial Design Office etc. The Izmir University of Economics implements a similar approach within the scope of the mentor-mentee program.

In the second scenario, with the guidance of the career office for the students' graduation thesis and project, the students will come to the manufacturer companies and a one-to-one connection will be established between the studio and the student during office hours.

IED has long-term internships which are inside of the semesters. Lectures and technical trips in the IEDs master's program can be a reference point. Visiting the manufacturers' areas and giving lectures with them, which is experienced in the Industrial design undergraduate program of the Izmir University of Economics, is a subject that will also be needed in automotive design in Turkey. FORD Otosan clay studio, GUNSEL Electric Vehicles clay studio or Hexagon studio prototype manufacturing areas can be visited, and notes should be taken. They appear to be. About half of the main industry companies argue that cooperation is sufficient.

In the third scenario, the career offices will be positioned as head-hunters, similar to career offices of CCS and IED; Here, career offices will make contact with companies according to the portfolio of each student and the right people will ensure networking. In this way, companies will once again meet with qualified and visionary designer students and add the right person to their team. These developments will contribute to the original Turkish design culture. Hidromek is one of the best examples in this regard. As of 2023, it has thirty-one global design awards (Makina Marker, 2023).

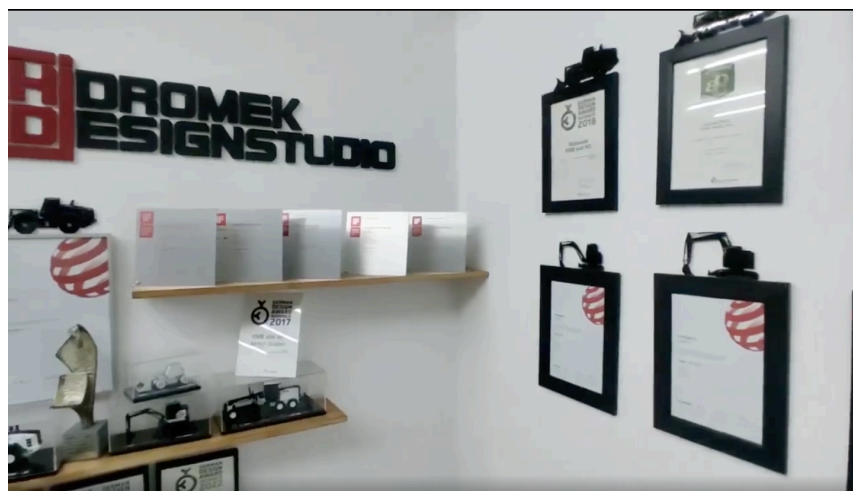


Figure 40. Hidromek Design Studio's some of global design awards (Source: Hidromek, 2023)

It has managed to become a company that has its own line and draws attention with its design. Similarly, Anadolu Isuzu has worked for and won many awards. Again, the Ford F-MAX truck of recent times received the truck design of the year award (Figure 3.12).



Figure 41. International Truck of the Year Award of FORD F-MAX (Source: Otosan, 2023)

Turkish success in these commercial vehicles also provides a positive effect on sales. There is no reason why this should not happen for passenger cars as well. In our country, apart from TOGG and GUNSEL, our own brand of passenger car company does not exist yet. Their numbers are increasing with companies such as Amperino and Merlyn Motors. It is our goal for these companies to increase their sales with good design and to offer innovative solutions. Amperino start-up can be examined, there can be seen that the design process has been advanced with the Sedat Öztürk design office, and it is a project that is connected to making a sound with its design even before it is released to the market. These positive developments will increase with this master program.

5.8. *Facilities*

The location and facilities in which education takes place have a significant impact on this process. Therefore, it is essential to provide creative spaces outside of the classroom for automotive design education. The higher education opportunities, which encompass a broader field of automotive design, may also be evaluated in our country's industrial design programs. These programs require studios with adequate lighting and ventilation, functional workshops suitable for working with materials such as wood and metal, classrooms, and exhibition areas (ENTAK, 2022). In addition, various new spaces can be provided to simulate the working environment and practices of automotive design offices.

A separate environment is created in the offices for work and practice in the Colour & Material area. Here, products such as sewing samples, fabric and vinyl types, plastic pattern studies, visual reference samples, different touch studies, and colour samples are archived. Here the colour and material theme of a vehicle is created. Likewise, a suitable environment can be created for students to meet materials in a similar area and to try their combinations.

In the field of clay modelling, scaled and one-part vehicle interior and exterior models are made. Here, the consumables are Styrofoam, MDF and plaster. It is very valuable for a student to learn to work with plaster in their education life. The design poured into the drawing first turns into reality in the clay model and the drawing must be experienced in this process. This is the reason why there are scaled and full-size vehicle designs in transport design finishing exhibitions in Europe. In this area, hand skills such as acquiring the habits of using the tools, making design mock-ups, and applying the plaster to the surface are developed.

Surface modelling and user interface designs are completely digital. Computer labs are needed for their training. Just like in the industrial design training programs, Computer Aided Styling (CAS) such as Autodesk Alias, blender, and User interfaces working tools such as Illustrator, After Effects, QT, and Kanzi, which are used in the sector, can be given. In addition to these areas, there may also be Wacom labs for digital sketching practice.

There are many types of prototyping today. table type CNC milling, lathe, laser cutter or 3d printers. All of their machines are beneficial in turning the design into reality and they need to be in the workshops.

As a result, this program is industry-focused from start to finish. It is a contribution that will support Turkey in getting out of the assembly logic and becoming a brand and design owner. A scheme similar to the industry-university partnerships that most departments in Turkey have successfully implemented has been designed.

A position that can respond to the need immediately and next to the location in need is targeted as in the example of OSTİM and Bursa Uludağ University.

The career office logic of schools such as Uludağ University, CCS and IED is referenced. It is the contribution here that the experts guide the students in drawing their own path.

It is a furniture design workshop, which is unquestionable part for design departments in furniture design. The unquestionable part of automotive design is the clay modelling workshop. It is suggested that which is rare in the professional environment in Turkey, should be given to students during the education period.

It is seen in many universities such as Izmir University of Economics and has a great contribution; The participation of part-time teachers from the professional world in the studio is exemplified. Since automotive design offices need to work in coordination with many branches, it is aimed to experience this diversity and information flow at the university level.

Employees spend the first six months and 1 year perceiving automotive design, as the industry currently fills industrial design and similar departments and design offices. As a quick remedy, this program will close the gap. The reason for choosing a master level education is in all design offices, there are currently employees from industrial design or similar higher education level, and this can be achieved with this master program so that these people can be channelled into their professions. In addition, in order for this program to grow in the future and contribute academically, it should be

possible for graduates of departments such as masters and doctorates to work in the institute in the future. Thus, there will be positive results such as loyalty to the department, meeting the staff needs of the department in the future and being heard quickly in the sector by graduating in a short time.

With an automotive design master program to be established within the above general framework, the industry's lack of qualified and visionary designers who can contribute to the future can be eliminated.



CHAPTER 6: CONCLUSION & SUGGESTIONS FOR FURTHER STUDIES

Up to this point, the automotive industry in Turkey, North Cyprus, and globally was analysed. The operational needs of automotive design offices within this sector were specified, along with the origins of employees' higher education design programs in these fields. Some selected higher education programs are selected with the matrix which specializing in transportation design. Their schedule, curriculum, human resources and industry connections are researched. These institutes' transportation design and industry focused education methods are examined detailly. After that Turkish context are examined. In here some selected businesses and universities are listed on how establish connections with each other in Turkey.

In chapter 5, the main part of the thesis is placed which is the model proposal for Turkey and North Cyprus. This chapter has referenced selected five institutions and sectoral needs. The research was filtered in the perspective of Türkiye.

Here, the same parameters were evaluated as in the researched institutions. Turkey's familiarity with industrial design departments goes back to fifty years. However, its sub-departments have not yet become widespread. Although Turkey is the locomotive of the furniture design and yachting industry, it can be seen that these design departments do not spread throughout the country. For this reason, wide ranged vehicle production and transportation design share the same fate. As a solution proposal, this model setup was designed by taking the researched universities as a reference and considering the sectoral development of the country.

The course needs of automotive design offices according to their working specialties, how human resources can be provided, where the central location can be, what type of training can be beneficial in what term are conveyed. Transportation design is the name of a very large-scale department, but in this field of education, passenger vehicle design is generally targeted in the world. In Turkey, vehicle design has spread over a wide area in the sector. The range is wide, from the defence industry to micro-mobility. The scope of this education in Turkey should be wide. In addition, the business areas

of the design offices are also branched. The way a UI designer and Clay models work is different. But the design philosophies are the same. For this reason, it is valuable that they go through the same training process. On top of that, clay models will specialize in the clay modelling course, while the UI interface designer will specialize in the UI design course. In industrial design, a situation similar to the fact that furniture courses are taken by everyone but not working in that sector can be shown. The output of the furniture lesson is the experience of the theories that are valid for every design field, such as experiencing production, static awareness, observing the whole process of design and exhibiting it, on the furniture product. A similar experience will be in the transportation design model, especially in the clay model. Additionally, A colour n trim designer needs to understand textiles and pattern design. For this reason, they should be able to receive training from a textile engineer or mold designer. For these and similar reasons, the area covered by this section is very wide. For this, it is a part of the industry that should be included.

There are some reasons that cause the formation of Bursa as a location here. These are the establishment of the first licensed automobile factory like TOFAŞ here. TOFAŞ Academy is also located here which the institution that trains its own internal training and internal trainers. There is also the fact that the sub-industry and OYAK Renault are in Bursa. Participation of Uludağ University, which has ties with the automotive sector, and is involved in the R&D projects of the sector and Tübitak research projects. It's close location to a metropolis like Istanbul. Finally, the fact that technical professionals has been a factor in this who can be evaluated in human resources are widespread in Bursa.

Finally, in chapter 6, an example interpretation planned of all above and as a result; how can be a training model could meet the needs of the automotive industry in Turkey.

In this section, which is the last part of the thesis, there will be discussion of automotive design studios and education globally and locally. Further that there will be an evaluation of this proposed education model and suggestions for further studies.

6.1. Discussion

In this proposal, it can be expected that other sectors as strong as automotive will also benefit from this and there will be breakdowns of education in those fields in the future. These are defence industry vehicle design, micro-mobility design, motorcycle design, construction equipment, agriculture vehicle and rail systems design. Also, the need for rail system and micro mobility design training must have been increased in Europe as well. The IED sees them as programs. For motorcycles, IAAD chose the path of specialisation within its vehicle design program. However, there is no breakthrough for the defence industry yet.

In Turkey, there has been a very widespread defence industry breakthrough. FNSS – defence industry company- which designs vehicles in various fields, opens the design competition every year, allowing industrial designers to add a design vision to them. On the other hand, companies such as Otokar, get over this with inhouse design office, BMC outsources the design from other design offices in Turkey such as DesignUm. This means that there is a need for design in this sector as well. This is one of the areas where there will be a need for specialisation in the future.

Turkey is a research and development heaven where the aircraft engineers have to work in a bicycle company and the automotive engineer has to work in a tractor company. Our higher education models are operating in areas that are not very specialised in terms of sectors. This will form the basis for future industries, and these will be done with qualified people, no doubt about it.

On the other hand, a contrasting trend is distinctive point in the industrial design area. Since the introduction of the first ANADOL vehicle in 1964, Turkey has planted an uninterrupted automotive production sector. As a result, the design landscape has been expanding continually. For instance, the FORD Courier vehicle, announced by FORD Otosan in 2023, was meticulously crafted at the Sancaktepe design office and will be marketed worldwide under the renowned FORD brand. This achievement can be attributed to the collaborative efforts of automotive engineers, automotive technicians, and graduates of motor vocational high schools. In the field of automotive design, personnel from industrial design and industrial product design backgrounds are sought

after in Turkey. Given the specialization observed in various academic disciplines, it be fitted to the specialization in automotive design as well.

The Turkish automotive sector, which is increasing and developing day by day, can take a step to educate and train their local automotive designers, and the industrialization that will ensure its continuity has already been established. Here is the example of Japan. Industry workers in Japan are allowed to enter the academy as an educator in their later years. Hattori Moriyoshi is an example here. Past experience general manager Suzuki Motor Corporation, then transferred to university and became an instructor. In this way, current sectoral information can be transferred to the student in the Academy. In addition, a flow of information can be provided between academic educators and industry-based educators. In Turkey, there are people who teach design at various Istanbul universities. These are the design managers of their own or global companies. This and similar valuable human resources should definitely be evaluated at the higher education stage.

As a result, this department proposal has been presented for the automotive designs can be made in Turkey of companies such as TOGG and GÜNSEL, which are shown as an example in the development of the country. The designers of these companies can be trained in Turkey, and students from nearby geographies can specialize in this field in Turkey. The program which covers most of the vehicle design manufacturers in Turkey. There is a future-oriented education program like the Royal College of art like mobility or IAAD model that only includes the motorcycle. These models can't be a realistic example for Turkey. Research has been put forward in the chapter 5 in order for this to happen. It has been seen that the selected universities have produced so similar content and human resources to each other. In addition to these, the way of doing automotive design industry has also been conveyed. Industry-university collaborations are also exemplified in Türkiye. It is also stated how the automotive manufacturers respond their own internal training needs. In the light of all this information, the proposed program model was planned in Chapter 5. This model is a proposal to detail both as a sub-branch of industrial design and to fill the gap needed by the industry. It can be a support factor for the development of vehicle design in every field in Turkey to go further.

6.2. *Suggestions For Further Studies*

Based on your thesis topic of automotive design education research from selected well known transportation design higher education institutes, with a focus on the Turkish automotive industry, I would suggest the following content for further studies:

In this thesis, while creating the model setup, research and thoughts were generally conveyed until the human resources, location, student admission conditions and curriculum.

i) More detailed studies can be done according to the lesson plan and the physiology of Turkish industry and students. In the above study, suggestions were presented for a wide scope in which mechanical automotive engineering and even painting and sculpture graduates can participate. However, perhaps this program can be designed in a narrower focus and detail. Just like CAS modellers and UI designer doing different jobs in a design office, maybe their training can be differentiated within the program. Their elaboration and effects should be questioned.

ii) Industrial design graduates with good results work in today's transportation design offices. It is questionable how these designers are good transportation designers. It can be researched what benefits they get from the higher education they receive. Thus, with the contributions of industrial design higher education, this program can be placed in a wider scope.

iii) A comparative study of automotive design education programs in other countries, particularly those with well-established automotive industries, to identify best practices and potential areas for improvement. Perhaps the program combined with engineering under a technical university, as in Delft University, would be appropriate here. Or this program can survive with a non-university post graduate institution such as
Poli Design.

iv) In this thesis, the automotive design graduate model was designed. The reason for this is that there was no such department in our country before and this short-term model was preferred in order to meet the academic needs more easily. Will other

variations of this model work in the short term that are not postgraduates, or maybe this just fills the need with certificate programs? Or can the existing designers be recruited into this field with the lifelong education mentioned before? These can be discussed in the short time timeframe.

v) How can this program survive in the mid-term period, which covers 1-5 years, and the long-term period, which covers 5-10 years. As mentioned above, does it make sense for this program to be a faculty or even a university in its own right, or is there not a sector in the country that would need it? If the sector will prefer to import ready-made outsource design like TOGG, then it should be evaluated whether this master program is also more than necessary.

vi) Qualitative assessment and crediting can work. European Credit Transfer and Accumulation System (ECTS) are not discussed here. However, in the later stages of this project, this crediting can be studied and its compliance with the norms can be discussed.

vii) Final suggestion of the thesis was built on creating a new program setup. However, this program can be replaced by the umbrella industrial design department. For example, IED Barcelona Product Design Program (Transportation Design Pathway) or Hacettepe University mechanical engineering department (automotive engineering program). Likewise, Bursa Technical University Industrial design department may be channelled to automotive and the process of opening a completely new department may not have been entered.

By addressing these topics, that can provide a comprehensive analysis of automotive design education in the context of the Turkish and North Cyprus's automotive industry and develop a proposal for a master's program that is tailored to the specific needs and opportunities of this rapidly evolving sector.

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