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The Importance and Evolution of Wearable Technology in Industrial Design Education in Turkey

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Abstract
By the development of technology, especially after the 2000s, the balances in the market have changed, and this differentiation has allowed new products and services to enter the market. Wearable technology products have become one of these. Enriching ordinary daily products with various accessories has enabled these products to transform into smart products that can perceive their surroundings and act in accordance with the physical environment they are in. When the design and creation processes of wearable technology products, which have made great progress and become widespread in recent years, are examined, there are many disciplines that contribute to the process of reaching the end user. Among these disciplines, the discipline of industrial design has a very important place. In this study, the relationship between the subject of industrial design graduate theses published in Turkey and wearable technology was analyzed. Bibliometric analysis is used as the method and the sample area was determined as YÖKTEZ. As a result of this study, it was determined that although the subject of wearable technology in the field of industrial design is new to this field, it has progressed day by day, and the field of industrial design can conduct interdisciplinary studies on this subject with other disciplines.
Keywords: Wearable technology, Industrial design, Bibliometric analysis, Product design, Partnerships for the goals.

1. INTRODUCTION

The development of digital and mobile technologies plays an active role in the change of individuals' daily lives. Internet connection in particular has become important for many people because it provides low-cost access to data and information, and because it is manageable and comfortable. These developments have shown that technology is now wearable rather than usable, and this has led to the emergence of wearable technologies (Sultan, 2015, p. 523).

Devices that can track users' body movements and have smart sensors are called wearable technologies. In other words, these devices, also called wearable computers, are devices that provide a common life between the user and the computer, improving the daily lives of individuals (Sezgin, 2019).

After the development of the first wearable technology product in 1961, developments in the field of wearable technology progressed even further in the 1980s with the advancement of technology day by day. Especially the 2000s were the period when wearable technology products gained momentum. One factor in gaining this momentum has been the developments in the fields of health, defense, entertainment and education. Wearable technologies have brought many products such as shoes and glasses used in daily life to us in different forms (Sağbaş et al., 2016). Wearable technology is a term used to refer to devices that a person wears or carries, such as glasses, clothing, sensors, or accessories containing other technologies (Aydan and Aydan, 2016, p. 326).

Wearable technology products, which have an important place in individuals' lives, also have some disadvantages. One of these problems is the weak connection between

wearable technology developers and wearable technology users (Ariyotum and Holland, 2003). Another problem caused by this problem is that although they are functional products, they cannot correctly analyze the visible or hidden needs or problems of users (Edwards, 2003). The fact that wearable technology developers prioritize technology has caused them to ignore the benefits to be provided to users (Sarı, 2015). This has been one of the important reasons why many wearable technology companies have not been able to commercialize their products in the past. Due to the fact that the designs were accepted as 'wearable computers' and the design paradigm was not fully understood, these designs were accepted as 'technology-focused' products. This acceptance could not go beyond making 'heavy' computers 'wearable'. (Öksüz, 2018)

Although the process of creating wearable technology products is known as a technical issue, the process of reaching the end user is carried out with the contribution of different fields such as textile, computer, fashion, design, and electronics. (McCann and Bryson, 2009). Innovative products emerge when different disciplines create common working areas. One of the most important conditions for wearable technology products to be successful is the combination of technology and design. This situation is effective in providing functionality and aesthetics at the same time. One of the important steps to be taken to prevent problems in the interaction with the user and the commercialization of products in wearable technology products is the formation of interdisciplinary teams. (McCann and Bryson, 2009).

Based on this information, the purpose of this study is to examine the graduate theses completed in industrial product design departments in Turkey on the subject of wearable technology, to determine the studies conducted, to introduce this field especially for individuals studying in the field of industrial design by presenting their contents, and to create areas of cooperation for different disciplines. The situation of wearable technology products, which gain meaning especially with the use of technology and design together, in industrial product design departments in Turkey was analyzed with the bibliometric analysis method.

2. CONCEPTUAL FRAMEWORK

Today, products with network connection and computing features are increasing and these products meet the demands and needs of users in daily life (Sağbaş et al., 2016). The concept of the product has changed especially with the developments in digital technologies, and the products used in daily life have evolved into smart products that can perceive their surroundings and behave in accordance with the physical environment they are in by adding equipment such as microchips and sensors (Pamir, 2010). The concept of *wearable technology* pertains to electronic devices embedded with sensors that continuously collect physiological or behavioral data from users and transmit it to connected digital systems in real time (Krey, 2019, p. 2). These technologies offer immediate, data-driven feedback by processing information gathered through their integrated sensing mechanisms (Erdmier et al., 2016, p. 141).

In the 2000s, technological advances have changed the balances in the market, and this differentiation has allowed new products and services to enter the market. (Tehrani et al. 2014). After these years, technological developments have changed the balances in the market and these changes and advancements have enabled the participation of new products and services in the market. One of the new products that have taken their place in the market due to advances in technology is wearable technology products. Especially considering the progress of Industry 4.0 and developments in technology, the year 2000 has been accepted as a turning point for these products. When wearable technology products are examined, it is seen that they tend to increase the cognitive, sensory and communication capacities of users. While doing all these, it is also an important point that users do not push their physical limits. Wearable technology products have advantages

such as fast interaction, ease of carrying, providing mobility and easy use. These products, which are widely used in daily life, are also very effective in saving time (Çakır et al., 2018).

Along with the development of technology, wearable technology products have become widespread and provide advantages to users, but there are also many disadvantages to these products. The fact that companies that offer wearable technology products to users primarily offer this service to people with high incomes and who follow technology closely has caused the connection between wearable technology producing companies and users to fail to be established (Ariyatum and Holland, 2003). In addition, the security problems in wearable technology products, the difficulty of adapting to daily life due to the more futuristic appearance of the products, the fact that the designs are technology-oriented and therefore cannot meet the hidden or visible wishes and needs of users can be shown as the biggest disadvantages of wearable technology products. (Öksüz, 2018). (Dunne, 2010). (Edwards, 2003). When the design and creation processes of wearable technology products are examined, there are many disciplines that contribute to the process of reaching the end user. These disciplines are; fashion, electronics, computers, textiles and design. The problems and disadvantages listed above can only be eliminated by using design and technology together. One of the studies to be done to solve the problems of interaction with the user and commercialization in wearable technology products is the formation of interdisciplinary teams. (McCann and Bryson, 2009).

One of the biggest actors in the interaction of technology with the end user in these interdisciplinary studies is industrial design.

The relationship between wearable technology and industrial design is mostly encountered in areas such as user experience, ergonomics and integration of technology. Wearable technologies have become an integral part of contemporary product design, representing a rapidly expanding category. The increasing demands of modern lifestyles, alongside user needs and advancements in manufacturing techniques, have contributed to the widespread adoption of wearable devices. A defining characteristic of these products is their physical integration with the human body, allowing for continuous and direct interaction with the user (Minaoglou et al., 2024). Unlike other technological devices such as laptops and smartphones, wearable technologies are designed to be worn directly on the human body. This fundamental difference necessitates a distinct design approach tailored specifically for wearables. Developing these devices involves integrating concepts, techniques, and materials from textiles, electronics, and software disciplines while accounting for the diverse range of users and their varying environmental contexts. Consequently, the success of wearable technologies is no longer solely defined by technical functionality but increasingly by delivering an optimal and seamless user experience (Francés-Morcillo et al., 2020).

This study aims to systematically examine graduate theses completed within industrial product design departments in Turkey that focus on wearable technology. The primary objectives are to identify and categorize the range of research conducted in this emerging field, to provide an overview of the thematic and methodological approaches adopted, and to introduce wearable technology as a significant area of inquiry for industrial design students and scholars. By presenting the contents and trends of these academic works, the study seeks to raise awareness about the integration of technology and design in wearable products, emphasizing their growing relevance in both academic and practical contexts.

Furthermore, the research aims to uncover opportunities for interdisciplinary collaboration by analyzing how different fields contribute to the development and conceptualization of wearable technologies. Employing bibliometric analysis, this study evaluates the current

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status of wearable technology research within industrial design education in Turkey, highlighting gaps, challenges, and potentials for future research and innovation. Ultimately, the study aspires to support the advancement of wearable technology as a specialized area within industrial design, encouraging cross-disciplinary cooperation and enriching the educational curriculum to better prepare future designers for this dynamic and evolving sector.

3. METHOD

Technology, which is constantly developing as a determining factor in individuals' lives and has become an inseparable part of daily experiences, has brought many innovations with it (Marangoz and Aydın, 2017). With the developing technology, it has enabled many disciplines to come together, not in a single field, and has created new innovations. One of the most important examples of interdisciplinary work has been wearable technology products (Çakır et al., 2018). One of the disciplines that developed and advanced wearable technology has been industrial design. The purpose of this study is to examine the graduate theses completed in industrial product design departments in Turkey on the subject of wearable technology, to determine the studies conducted, to present their contents, to introduce this field especially for individuals studying in the field of industrial design, and to create areas of cooperation for different disciplines. The tendency of industrial design departments in Turkey towards the subject of wearable technology products, which gain meaning especially with the use of technology and design together, has been revealed by analyzing the completed graduate theses with the bibliometric analysis method by taking certain criteria into consideration. This study is a bibliometric study that analyzes the graduate theses on wearable technology completed in the field of industrial design in Turkey in terms of thesis type, publication year, university where they were published, advisor title, advisor fields, educational background of the researchers conducting the thesis, keywords of the theses, research methods and data collection techniques. Due to the high number of academic studies conducted in the field of wearable technology in recent years, it was deemed necessary to conduct these analyses in order to determine the course of wearable technology in the industrial design discipline. At the same time, this study is important in terms of being a preliminary preparation for theses on wearable technology to be conducted in the field of industrial design in the future.

Bibliometric analysis is an analysis technique used to determine the progress, productivity and importance of various sources in certain fields (Mishra et al., 2014). Bibliometric analysis is a research method that is used quite frequently in terms of scanning and analyzing scientific research. (Pendlebury, 2008:2).

This analysis method is defined as an analysis technique used to provide an in-depth examination of previously conducted studies in a certain field, to allow the development and renewal of the relevant literature, to aim to increase the impact of the subject in the literature and to benefit from more research on the subject by determining its qualities (Palmer et al., 2005:176).

Today, developments in information technologies have made it possible to access information easily and cheaply, and have increased the amount of accessible information. At this point, it is very important to sort the information obtained, to ensure that it does not remain as a data pile that does not provide any benefit, with its source security and up-to-dateness. Therefore, classifying data rather than working with data in bulk allows for better analysis and access to the correct, reliable and sufficient information needed. One of the methods that can be used for this purpose is bibliometric analysis. Bibliometric studies are studies that reveal the current status, direction and development of studies in the existing literature on a branch of science (Üsdiken and Pasadeos, 1993).

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In this study, theses written in the field of industrial design in Turkey and scanned in YÖKTEZ were examined with a multidimensional perspective using bibliometric analysis, a qualitative research method. In this research, the number of theses published in the search conducted with the keyword 'Wearable Technology', the fields in which these theses were published, the number and distribution of theses in the field of industrial design, the universities and departments in which the theses were completed, the years in which the theses were published, the keywords in the theses, the fields of the theses writers, the titles and fields of education of the thesis advisors, the page numbers of the theses and the languages of writing were analyzed.

4. FINDINGS

4.1 Number of Theses

A total of 131 master's theses and 46 doctoral theses were found in the search made in YÖKTEZ with the keyword 'wearable technology' as shown in Table 1.

Table 1. Number of theses

TYPE OF THESIS	FREQUENCY (f)	%
MASTER'S THESIS	131	%74
DOCTORAL THESES	46	%26

4.2 Analysis of Theses According to Fields

Among the 131 master's theses found in the analysis, the primary subject areas were computer engineering, electrical and electronics engineering, science and technology, textile engineering and business administration. As shown in Table 2, the number of theses in the field of Industrial Design is 3 and it ranks 10th.

Table 2. Analysis of master's theses according to fields

Primary Subject (Fields)	Frequency (f)	Percentage (%)
Computer Engineering	25	19.08
Electrical Electronics Engineering	16	12.21
Science and Technology	9	6.87
Textile Engineering	8	6.10
Business Administration	8	6.10
Fine Arts	6	4.58
Clothing Industry	5	3.81
Sport	4	3.05
Bioengineering	4	3.05
Industrial Design	3	2.29
Architecture	3	2.29
Defense and Defense Technologies	3	2.29
Mechanical Engineering	3	2.29
Health Institutions Management	3	2.29
Education	2	1.52
Information and Document Management	2	1.52
Management Information Systems	2	1.52
Metallurgical Engineering	2	1.52
Physics and Physics Engineering	2	1.52
Communication Sciences	2	1.52
Health Management	2	1.52
Physiotherapy and Rehabilitation	2	1.52
Civil Engineering	1	0.76
Forensic medicine	1	0.76
Engineering Sciences	1	0.76

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Urbanism and Regional Planning	1	0.76
Physical Medicine and Rehabilitation	1	0.76
Western Languages and Literature	1	0.76
Economy	1	0.76
Mechatronics Engineering	1	0.76
Chemical Engineering	1	0.76
Chemistry	1	0.76
Law	1	0.76
Polymer Sciences and Technology	1	0.76
Philosophy	1	0.76
Industrial Engineering	1	0.76
Biotechnology	1	0.76

In the analysis conducted with the keyword wearable technology, the first five primary subjects of the 46 doctoral theses were determined as computer engineering, industrial product design, electrical and electronics engineering, science and technology, and nursing as shown in Table 3.

Table 3. Analysis of doctoral theses according to fields

Primary Subject (Fields)	Frequency (f)	Percentage (%)
Computer Engineering	8	17.39
Industrial Design	7	15.21
Electrical Electronics Engineering	5	10.86
Science and Technology	3	6.52
Nursing	3	6.52
Business Administration	3	6.52
Physiology	2	4.34
Communication Sciences	2	4.34
Tourism	1	2.17
Textile Engineering	1	2.17
Energy	1	2.17
Performing and Visual Arts	1	2.17
Banking	1	2.17
Law	1	2.17
Chemistry	1	2.17
Sport	1	2.17
Education and Training	1	2.17
Geodesy	1	2.17
Engineering Sciences	1	2.17
Health Institutions Management	1	2.17

When the obtained data was examined, it was concluded that the number of doctoral theses was higher than master's theses and was ahead of other disciplines when the postgraduate theses searched in YÖKTEZ with the keyword wearable technology in the field of industrial design were examined. It can be said that this topic is a more popular topic for doctoral theses among the theses published in the field of industrial design. When theses are published in the field of wearable technology, which is generally accepted as a technical subject in the literature, are examined, it is seen that engineering sciences are at the top. However, the fact that the discipline of industrial design has left many disciplines behind in the ranking of doctoral theses shows that this subject has an important place in the discipline of industrial design.

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4.3 Master's and Doctoral Theses in the Field of Industrial Design with the Keyword 'Wearable Technology'

As a result of the analysis, industrial product design is ranked 10th among the master's theses in the field of wearable technology with 3 completed theses. When these three master's theses were examined, it was determined that one thesis was completed in the field of textile engineering but industrial product design was selected as the primary subject and this thesis was excluded from the research. There are two theses that received a master's degree in the field of industrial product design. There is a total of 7 theses in the discipline of industrial product design that were published in YOKTEZ as doctoral theses and worked in the field of wearable technology**.** It can be seen in Table 4 below.

Table 4. Number of master's and doctoral theses in the field of industrial design with the keyword 'wearable technology'

TYPE OF THESIS	FREQUENCY (f)	%
MASTER'S THESIS	2	%22
DOCTORAL THESES	7	%78

When the obtained data is examined, the number of doctoral theses in the search made with the keyword wearable technology in the field of industrial design is higher than the number of master's theses**.**

4.4 Universities and Departments in which Postgraduate Theses are Completed and Published

One of the two master's theses was completed at Bilkent University and the other at Eskişehir Technical University as shown in Table 5.

Table 5. Universities and departments of master's theses are completed and published

THESES	UNIVERSITY AND DEPARTMENT
MT 1	Bilkent University , Communication & Design
MT 2	Eskişehir Technical University, Industrial Design

As a result of the examined theses, it was concluded that the master's theses were conducted in two different universities. In these universities, the department distributions were as industrial design and communication & design.
The university and department information of the seven doctoral theses completed in the industrial design discipline examined with the keyword wearable technology are as follows in Table 6;

Table 6. Universities and departments of doctoral theses are completed and published

THESIS	UNIVERSITY AND DEPARTMENT
DT 1	İstanbul Technical University, Industrial Design
DT 2	Mimarsinan Fine Art University, Industrial Design
DT 3	Koç University, Technology & Society, Interaction Design
DT 4	Universidade Europeia (Portugal), Design
DT 5	İzmir University of Economics, Design Studies
DT 6	Middle East Technical University, Industrial Design
DT 7	İstanbul Technical University, Industrial Design

When the obtained data were examined, it was concluded that two of the seven published doctoral theses were studied at Istanbul Technical University, Industrial Design Department. When the department distribution is examined, there are four industrial design, one Technology & Society, Interaction Design, one design and one design studies.

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4.5 Years of Publication

The years in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 7 below.

Table 7. Years of publication/master's theses

THESES	YEAR
MT 1	2015
MT 2	2023

The years in which seven doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 8 below.

Table 8. Years of publication/doctoral theses

THESIS	YEAR
DT 1	2023
DT 2	2023
DT 3	2017
DT 4	2022
DT 5	2024
DT 6	2023
DT 7	2020

When the publication years of postgraduate theses are examined, the first postgraduate thesis belongs to 2015 and is a master's thesis. No master's thesis was found in this field until 2023, the year the second master's thesis was published. When the years of doctoral theses are examined, it is seen that there is a distribution between 2017-2024, and the studies are concentrated in 2023. The 2000s, which are a turning point for the subject of wearable technology, also show themselves as important years in academic studies.

4.6 Key Words in the Theses

The key words in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown below.

MT 1: **Wearable Technology**, Mobile Media, Human-Computer Symbiosis, Transhumanism, Post-Human, The Quantified Self and Internet of Things
MT 2: Wearable Technology, Pneumatics, Soft Robotics, Maker

The key words in which seven doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown below
No keyword information was found in theses coded **DT 1, DT2, DT3, DT7.**

DT 4: Fashionable Wearables; Sustainable Behavior; Smart City**; Human-Centered Design**; Design for Behavior Change
DT 5: Smart glove, visually impaired, assistive technologies, **wearable technologies, image processing, user-centered design**.
DT 6: Animal-computer interaction, dog, animal welfare, dog activity **monitoring systems.**

When the keywords of the master's theses were examined, the common keyword was determined as 'wearable technology'. When the data obtained from the doctoral theses were examined, keyword information could not be reached in four doctoral theses, and in the other theses, the keyword user/human centered, which is one of the important topics of wearable technology and industrial design, came to the fore. Apart from that, topics

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such as image processing and monitor systems, which are considered to be more technical fields, are also common keywords.

4.7 Education Field of Theses Writers

The education field in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 9 below**.**

Table 9. Education field of theses writers / master's theses

THESES	UNDERGRADUATE	DEPARTMENT	POST GRADUATE	DEPARTMENT	Ph.D.	DEPARTMENT
MT1	TOBB University of Economics and Technology	Industrial Design	Bilkent University	Communication & Design	Gazi University	No information
MT2	Anadolu University	Industrial Design	Middle East Technical University	Industrial Design		

When the data is examined, the fields in which the master's thesis writers are educated are determined as industrial design. There is no interdisciplinary field of education.
The education field in which doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 10 below.

Table 10. Education field of theses writers / doctoral theses

THESES	UNDERGRADUATE	DEPARTMENT	POST GRADUATE	DEPARTMENT	Ph.D.	DEPARTMENT
DT 1	Anadolu University	Industrial Design	Anadolu University	Industrial Design	İstanbul Technical university	Industrial Design
DT 2	Mimarsinan Fine Art University	Industrial Design	Mimarsinan Fine Art University	Industrial Design	Mimarsinan Fine Art University	Industrial Design
DT 3	İstanbul Technical University	Industrial Design	-	-	Koç University	Technology & Society, Interaction Design
DT 4	Anadolu University	Fashion Design	Gazi University	Fashion Design	Universida de Europeia	Design
DT 5	Ege University	Economics	İzmir University of Economics	Design Studies	İzmir University of Economics	Design Studies
DT 6	Middle East Technical University	Industrial Design	Middle East Technical University	Industrial Design	Middle East Technical University	Industrial Design
DT 7	Erciyes University	Textile Engineering	Istanbul Technical University	Industrial Design	Istanbul Technical University	Industrial Design

When the education fields of the authors of the doctoral theses published in this field are examined, it is observed that they focus on industrial design and design fields. The undergraduate educations of the two authors differ from design fields. The authors who received undergraduate education in textile engineering and economics later advanced from the field of industrial design. This data also shows that the education fields of the authors working on wearable technology in this field show a more interdisciplinary distribution.

4.8 Supervisor's Titles and Education Fields

The education field and titles of supervisor in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 11 below.

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Table 11. Supervisor's titles and education fields/master' theses

THESES	TITLE	UNDERGRADUATE	DEPARTMENT	POST GRADUATE	DEPARTMENT	Ph.D.	DEPARTMENT
MT1	Assist. Prof	No info.	-	-	-	-	-
MT2	Assist. Prof	Istanbul Technical University	Mechanical Engineering	Eskişehir Osman Gazi University	Mechanical Engineering	Anadolu University	Ceramic Engineering

When the obtained data were examined, it was observed that the titles of the two master's thesis advisors were the same. The educational information of one advisor could not be reached. When the educational information of the other master's thesis advisor was examined, an interdisciplinary education field was seen. Another important information obtained here is that the thesis advisor's education consists entirely of engineering discipline.

The education field and titles of supervisor in which seven doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 12 below.

Table 12. Supervisor's titles and education fields/doctoral theses

THESES	TITLE	UNDERGRADUATE	DEPARTMENT	POST GRADUATE	DEPARTMENT	Ph.D.	DEPARTMENT
DT 1	Assoc.Prof.	Istanbul Technical University	Industrial Design	Mimarsinan Fine Art University	Clothing Design	University of Minnesota	Design
DT 2	Prof.	Mimarsinan Fine Art University	Industrial Design	Mimarsinan Fine Art University	Industrial Design	Mimarsinan Fine Art University	Industrial Design
DT 3	Prof.	No info.	-	-	-	-	-
DT 4	Assist. Prof	Universida de Europeia	Product Design	Universida de Europeia	Ergonomics in Occupational Safety	Universida de Técnica de Lisboa	Human Kinetics with specialization in Ergonomics
DT 5	Assoc.Prof.	Dokuz Eylül University	Textile Engineering	Dokuz Eylül University 2. Niederrhein University	Textile Engineering 2. Textile and Clothing Management	Dokuz Eylül University	Textile Engineering
DT 6	Assist. Prof	Middle East Technical University	Industrial Design	Middle East Technical University	Industrial Design	Middle East Technical University	Industrial Design
DT 7	Prof.	Middle East Technical University	Industrial Design	Bilkent University	Graphic Design	Bilkent University	Graphic Design

The title information of the examined doctoral thesis advisors is as follows: three advisors are Prof., two advisors are Assoc. Prof., and two advisors are Assist. Prof. When the education fields of the thesis advisors are examined, only two advisors have an entire education field of industrial design. The education fields of the thesis advisors other than these are interdisciplinary as shown in Table 13.

4.8.1 Co-supervisor

Table 13. Co-supervisor's titles and education fields / doctoral theses

THESES	TITLE	UNDERGRADUATE	DEPARTMENT	POST GRADUATE	DEPARTMENT	Ph.D.	DEPARTMENT
DT 4	No info.	University of Beira Interior-UBI, Portugal	Textile Engineering	University of Beira Interior-UBI	Textile Engineering	University of Beira Interior-UBI	Science and Technology of Textile
DT 6	Prof.	Ankara University	Veterinary Medicine	Tieraerztliche Hochschule Hannover	Animal Welfare and Behavior	Ankara University	Physiology

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Co-advisor support was received for two doctoral theses. The fact that the DT 6 coded thesis advisor's entire field of education is industrial design and the co-advisor who received support was chosen from a different field creates an interdisciplinary structure for the thesis.

4.9 Page Numbers and Language of Theses

The page numbers and language in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 14 below.

Table 14. Page numbers and language of master's theses

THESIS	PAGE NUMBER	LANGUAGE
MT 1	121	English
MT 2	145	Turkish

The average number of pages of master's theses written in this field is 133. The languages in which the theses are published are equally distributed as Turkish and English.

The page numbers and language in which seven doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown in the Table 15 below.

Table 15. Page numbers and language of doctoral theses

THESIS	PAGE NUMBER	LANGUAGE
DT 1	191	Turkish
DT 2	221	Turkish
DT 3	278	English
DT 4	372	English
DT 5	194	English
DT 6	310	English
DT 7	350	Turkish

The average number of pages of doctoral theses written in this field is 274. The languages in which the theses were published are distributed as 4 in English and 3 in Turkish.

4.10 Methods of Theses

The methods in which two master's theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown below.

MT 1: Case study
MT 2: Prototype design, user testing

The methods in which seven doctoral theses published in the field of industrial design and having the keyword 'Wearable Technology' were published are shown below.

DT 1: Questionnaire, Journal-interview method, Semi-structured interviews
DT 2: Interview
DT 3: Participatory design workshop, designing a prototype, user testing
DT 4: Expert Interview, Systematic Literature Review, Concept Mapping, Focus Groups, Card sorting, Opportunity Mind Mapping, Designing a prototype, User Experience Questionnaire
DT 5: Questionnaire, design a prototype, user test

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DT 6: Questionnaire, semi-structured interviews
DT 7: Semi-structured interviews – design audits

When the methodology of the theses was examined, surveys, interviews, prototype production and user testing were the most commonly used methods.

5. CONCLUSION

Technology has become a decisive element in individuals' lives, continuously evolving and becoming an integral part of daily experiences (Marangoz & Aydın, 2017). These technological advancements have brought about numerous innovations and, in particular, have encouraged interdisciplinary collaborations. In this context, the design process of wearable technology products stands out as a significant example of interdisciplinary cooperation (Çakır et al., 2018). The design of wearable technologies is shaped through the contributions of various disciplines, ranging from engineering and healthcare to informatics and industrial design.

In this study, postgraduate theses published in the field of industrial design and retrieved from the Council of Higher Education Thesis Center (YÖKTEZ) using the keyword "wearable technology" were examined. The findings reveal that research in this area has been conducted since 2015; however, the number of studies remains limited. The fact that only two master's theses have been conducted within the field of industrial design indicates that the topic has not yet been sufficiently addressed in postgraduate education. This presents a significant opportunity for prospective designers who aim to specialize in this field.

The increasing number of doctoral theses focusing on wearable technologies within industrial design, and the fact that these theses rank second among disciplines, demonstrate a rising awareness of the field in recent years. One of the most significant challenges in the commercialization of wearable technologies—product-user interaction (Ariyotum & Holland, 2003)—has been addressed in these theses, where various methods have been developed to overcome this issue. The keywords and research methodologies employed are oriented toward enhancing the relationship between the product and the user.

In particular, the methodologies developed to understand user needs in doctoral theses, along with the creation of prototypes and their user testing, enable the analysis of both explicit and latent user expectations, thereby contributing to the commercialization process (Sarı, 2015). The fact that wearable technologies are often perceived as technology-centered products has led to inadequacies in terms of user experience. However, through the lens of industrial design, there is now a path toward redesigning these products to offer more user-centered solutions.

An analysis of the educational backgrounds of thesis authors and advisors reveals frequent instances of interdisciplinary structures. The argument in the literature that wearable technologies should be developed through interdisciplinary collaboration (McCann & Bryson, 2009) is supported by the findings of this study. Furthermore, the inclusion of co-advisors in doctoral theses further reinforces this interdisciplinary structure.

In conclusion, this study not only highlights the importance of interdisciplinary collaboration for designers but also reveals that the field of wearable technologies presents a new specialization and employment area for individuals with a background in design education. Wearable technologies offer students not only a new field of expertise but also a forward-looking vision that diversifies employment opportunities in the industry. Each thesis produced in this field represents not only an individual academic achievement but also a valuable contribution to the development of the discipline. Therefore, students have the opportunity to distinguish themselves and add value to the academic world through

original research in this emerging area. The growing significance of wearable technology products in design education underscores the need for increased academic work in this field and the active involvement of industrial designers in these processes.

The diversity of disciplinary backgrounds among the thesis authors and advisors analyzed in the YÖKTEZ database reveals that interdisciplinary collaboration is indispensable for academic production in this field. From an academic standpoint, this highlights the necessity of supporting practices such as co-advisorship in thesis studies, promoting methodological diversity, and encouraging user-centered design research. Wearable technologies offer not only technical innovation but also rich research opportunities in social, individual, and cultural domains.

In this regard, the field of wearable technologies offers academics strategic opportunities in terms of developing postgraduate education programs, promoting joint research projects, and increasing university-industry collaborations. Given that the field is still emerging, it holds great potential for academic leadership and the development of theoretical frameworks.

REFERENCES

Ariyatum, B. Holland, R. (2003), A Strategic Approach to New Product Development in Smart Clothing, *Journal of the Asian Design International Conference*, *1* (70), 14-17.

Aydan, S., Aydan, M. (2016). Sağlık hizmetlerinde bireysel ölçüm ve giyilebilir teknoloji: olası katkıları, güncel durum ve öneriler. Hacettepe Sağlık İdaresi Dergisi, 19(3), 325-342.

Çakır, S.F., Aytekin, A. ve Tüminçin, F. (2018). 'Internet of Things and Wearable Techologies', Journal of Social Research and Behavioral Sciences, 4(5): 84-95.

Dunne, L., (2010). Smart Clothing in Practice Key Design Barriers to Commercialization, *The Journal of Design, Creative Process & the Fashion Industry, 2* (1), 41-65

Edwards, C. (2003). Wearable computing struggles for social acceptance. *IEE Review*, *49*(9), 24-25.

Erdmier, C., Hatcher, J., Lee, M. (2016). Wearable device ımplications in the healthcare industry. Journal of Medical Engineering & Technology, 40(4), 141-148.

Francés-Morcillo, L., Morer-Camo, P., Rodríguez-Ferradas, M. I., Cazón-Martín, A. (2020). Wearable Design Requirements Identification and Evaluation. *Sensors (Basel, Switzerland)*, *20*(9), 2599. https://doi.org/10.3390/s20092599

Krey, M. (2019). Wearable device technology in healthcare-exploring constraining and enabling factors. In Fourth International Congress on Information and Communication Technology (pp. 1-13). Singapore: Springer. Available online: https://doi.org/10.1007/978-981-15-0637-6_1

Marangoz, M., Aydın, A. E. (2017). Factors Affecting Consumers' Acceptance of Wearable Technology Products: A Research on Smartwatches, *Pazarlama Teorisi ve Uygulamaları Dergisi*

McCann J., Bryson D. (2009). *Smart clothes and wearable technology*. CRC Press LLC. USA

Minaoglou, P., Efkolidis, N., Manavis, A., Kyratsis, P. (2024). A Review on Wearable Product Design and Applications. *Machines*, *12*(1), 62. https://doi.org/10.3390/machines12010062

Mishra, D. K., Gawde, M., Solanki, M. S. (2014). Bibliometric study of PhD thesis in English. *Global Journal of Academic Librarianship*, *1*(1), 19-36.

Öksüz, E. (2018). Giyilebilir Sağlık Teknolojileri, *Actual Medicine, 26* (4), 34-41.

Palmer, M.A., Bernhardt, E.S., Allan, J.D., Lake, P.S., Alexander, G., Brooks, S., Carr, J., Clayton, S., Dahm, C., Follstad Shah, J., Galat, D.J., Gloss, S., Goodwin, P., Hart, D.H., Hassett, B., Jenkinson, R., Kondolf, G.M., Lave, R., Meyer,

J.L., O'Donnell, T.K., Pagano, L., Srivastava, P. Sudduth, E. (2005) Standards for ecologically successful river restoration. *Journal of Applied Ecology*, 42, 208–217.

Pamir, N. (2010). Smart Products: Technological Applications vs User Expectations. (Yüksek Lisans Tezi), Ortadoğu Teknik Üniversitesi Sosyal Bilimler Enstitüsü, Ankara

Pendlebury, S. (2008). Accuracy, sincerity and capabilities in the practice of teaching. *Studies in Philosophy and Education*, *27*, 173-183.

Sağbaş, E., Ballı A., Yıldız S., (2016). Giyilebilir Akıllı Cihazlar: Dünü, Bugünü ve Geleceği. *Adnan Menderes Üniversitesi 18. Akademik Bilişim Konferansı*. Aydın

Sarı, H. (2015), "*Giyilebilir Teknoloji Pazarı 2019'da 53 Milyar Dolar Olacak*", http://www.dunya.com/kultur-sanat/giyilebilir-teknoloji-pazari- 2019 da-53-milyar-dolar-olacak-haberi-27 3852, (06.03.2017).

Sezgin, S. (2019). Eğitimde giyilebilir teknolojiler: firsatlar ve eğilimler. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, *1*(40).

Sultan, N. (2015). Reflective thoughts on the potential and challenges of wearable technology for healthcare provision and medical education. International Journal of Information Management, 35 (5), 521–526

Tehrani, K., Michael, A. (2014). Wearable technology and wearable devices: Everything you need to know. *Wearable Devices Magazine*, *26*.

Üsdiken, B., & Pasadeos, Y. (1993). Management literature and organizations in Turkey. *Journal of Public Administration*, *26*(2), 73-93.