International DESIGN JOURNAL
Print ISSN 2090-9632
Online ISSN 2090-9640

A Proposed Model of the Industrial Product Design Process Based on the User Experience Design UXD Process.

Prof. Ahmed Waheed Mustafa
Professor of Design, Department of Metal Products and Jewelry, Faculty of Applied Arts, Helwan University, ahmedwms@hotmail.com
Prof. Mahmoud Abdel Nabi Muhammad
Professor of Design, Department of Metal Products and Jewelry, Faculty of Applied Arts, Helwan University, mahmoudahmed1964@gmail.com
Amira Mohammad Mohammad Essawy
Ph.D. Researcher, Freelance designer, Department of Metal Products and Jewelry, Faculty of Applied Arts, Helwan University, AmiraMuhammad@a-arts.helwan.edu.eg

Abstract

This paper presents a conceptual model that integrates the principles of User Experience Design (UXD) into the industrial product design process. As the industry faces increasing demands for user-centered and intuitive products, this model aims to improve the overall user experience in product development. The proposed model adapts key stages of the UXD process—research, ideation, prototyping, and testing—within the context of industrial product design, ensuring that the product meets both functional and emotional user needs. This paper outlines a step-by-step process to align industrial design more closely with the principles of user experience, enhancing the final product's usability and satisfaction for end-users. Objective: The primary objective of this paper is to offer a method for industrial designers to create products that not only meet functional and aesthetic requirements but also provide a seamless and satisfying user experience. Methodology: The study employs a deductive reasoning approach to model development, utilizing existing UXD frameworks and adapting them to the industrial product design context. The research includes a comprehensive review of current literature on both industrial design and UXD processes. From these findings, a step-by-step process model was created and tested in hypothetical design scenarios to evaluate its applicability and effectiveness.

Keywords

Industrial Product Design Process, User Experience Design, UXD Process, Product Development, User-Centered Design. Human-Centered Design

Paper received October 10, 2024, Accepted January 27, 2025, Published on line March 1, 2025

Introduction:

The industrial design field has traditionally focused on creating functional, aesthetically pleasing products, with an emphasis on form and engineering. However, with the rise of user-centered approaches, there is growing recognition of the importance of integrating the User Experience Design (UXD) process into product development. This shift seeks to enhance not only the physical attributes of products but also the overall user experience. The UXD process, widely adopted in digital design, provides valuable frameworks that can be applied to industrial design to improve user satisfaction and usability.

This paper proposes a model that adapts the UXD process to industrial product design, considering the unique challenges and requirements of physical product development. The aim is to provide a structured approach for industrial designers to incorporate user feedback and testing at each stage of the design process.

Objective:

- Offer a method for industrial designers to create products that not only meet functional and aesthetic needs but also deliver a seamless, satisfying experience for the use.

Methodology:

- Deductive reasoning approach.

Significance:

- By integrating these processes, Industrial designers can create products that not only meet technical specifications but also provide a positive and intuitive user experience.
- The proposed model offers practical guidelines

CITATION Ahmed W Moustafa, et al. (2025), A Proposed Model of Industrial Product Design Process Based on the User Experience Design UXD Process, International Design Journal, Vol. 15 No. 2, (March 2025) pp 551-558

for industrial designers looking to enhance their product development strategies with a user-centered focus.
- This shift is crucial in today's competitive market, where user satisfaction can significantly impact product success.
- Giving attention to exceeding user satisfaction has a significant impact on product success in today's competitive market.

Theoretical framework:

User Experience Design UXD:

User experience UX is an interdisciplinary field, where UX designers come from diverse backgrounds, including graphic design, programming, psychology, and interaction design. Designing for human users involves considering a broader range of factors, such as accessibility, and accommodating various physical limitations, like the difficulty of reading small text (Lidman, 2020).
Experience design XD centers on creating designs that enhance the user's overall interaction with a product, service, or environment (Norman, 2013). While it may be challenging or even impossible to design a complete experience, the emphasis should be on crafting a design that guides toward the intended experience.

User experience design UXD is the process through which design teams create products that deliver meaningful and relevant experiences to users. This process encompasses the entire lifecycle of a product, including acquisition, integration, branding, design, usability, and functionality (Interaction Design Foundation, 2016).
The specific tasks a UX designer performs may differ depending on the company or the project domain. However, common activities often include conducting user research, developing personas, creating wireframes and interactive prototypes, and testing design concepts. Most UX designers follow a user-centered approach, continuously applying their expertise to refine solutions until they are successfully implemented (Propulsé, 2020).
User Experience Design UXD Process:
The User Experience design UXD process is a series of steps aimed to creating products that provide meaningful and relevant experiences to users. It focuses on enhancing user satisfaction by improving the usability, accessibility, and pleasure provided during the interaction with the product. (Norman, 2013)
The key steps of the UX design process are: Figure 1

Figure 1 User Experience Design UXD Process

1. **User Research:**
- Goal: Understand users' needs, behaviors, and goals.
- Methods: Interviews, surveys, focus groups, and field studies.
- Outcome: Creation of user personas, journey maps, and a clear understanding of the user's problems.
- Why it matters: It ensures that the design decisions are based on real user data rather than assumptions. (IxDF, 2016)

2. **Define (Problem Definition):**
- Goal: Define the core problem your product should solve.
- Methods: Create user personas, problem statements, and user stories.
- Outcome: A clear design goal, well-framed problem, and defined user journey.
- Why it matters: Helps guide the design process to focus on solving the right problem. (Rosala, 2021)

3. **Ideation:**
- Goal: Generate multiple ideas to solve the user's problem.
- Methods: Brainstorming, mind mapping, and sketching.
- Outcome: Many potential solutions are generated, from which the best concepts are selected.
- Why it matters: It helps designers explore a wide range of solutions before settling on the best one. (IxDF,2016)

4. **Prototyping**:
- Goal: Create a scaled-down version of the product or a specific feature to test design ideas.
- Methods: Paper prototypes, wireframes, or interactive digital prototypes.
- Outcome: Low or high-fidelity prototypes that visualize the functionality and interface.
- Why it matters: Early prototypes provide insights into usability and user interaction before the final product is developed. (UXPin, 2016)

5. **Testing:**
- Goal: Evaluate the design by testing it with real users.
- Methods: Usability testing, A/B testing, or surveys.
- Outcome: Feedback that identifies issues and potential improvements.
- Why it matters: It validates the design, ensuring

it meets users' needs and is functional. (Moran, 2019)

6. **Implementation (Development):**
- Goal: Transition the design into a fully functional product.
- Methods: Collaboration between designers and developers to implement the final design.
- Outcome: The final product is developed based on the validated prototype.
- Why it matters: It ensures that the product built aligns with the user-centered design solutions. (Ewa, 2023)

7. **Iteration:**
- Goal: Continuously improve the design based on user feedback and performance data.
- Methods: Regular updates, refinements, and testing.
- Outcome: A product that evolves to better serve user needs over time.
- Why it matters: It allows for continual improvement and adaptation of the product as user needs and behaviors change. (Ivanova, Lee & Jane, 2021)

Each step contributes to building a product that is user-centered and delivers a seamless experience.

Industrial Product:

According to Norman, industrial design focuses on form and material, aiming to enhance the value, functionality, and appearance of products and systems by developing concepts and detailed specifications. The goal is to improve the experience for both the user and the manufacturer. (Norman, 2013)

Traditional Industrial Product Design Process:

The Traditional Industrial Product Design Process refers to a systematic approach used by designers and engineers to create and develop physical products. It involves several stages from concept to production, ensuring that the product is functional, aesthetically appealing, economically viable, and manufacturable. The key stages typically involved in this process are: Figure 2

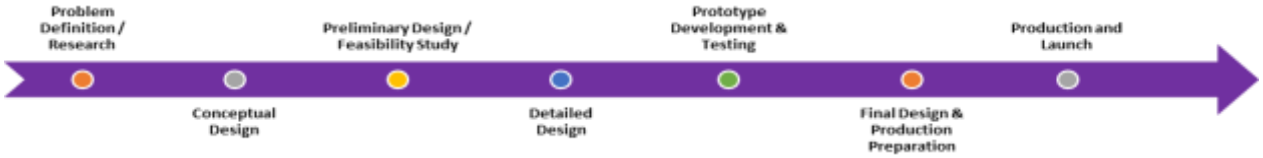

Figure 2 Traditional Industrial Product Design Process

1. **Problem Definition / Research:**
- Goal: Identify the problem or need in the market.
- Activities:
  - Conducting market research, user interviews, and competitive analysis.
  - Identifying user needs, pain points, and opportunities for innovation.
  - Defining constraints such as cost, materials, and target audience.
- Output: Design brief or specification outlining key objectives, challenges, and requirements. (Ulrich & Eppinger, 2015)

2. **Conceptual Design:**
- Goal: Generate a wide range of ideas and potential solutions.
- Activities:
  - Brainstorming ideas, sketching rough concepts.
  - Exploring various design directions and approaches.
  - Considering initial feasibility, aesthetics, and user interaction.
- Output: Concept sketches, mood boards, and rough models. (Cross, 2000)

3. **Preliminary Design / Feasibility Study:**
- Goal: Evaluate the technical and economic feasibility of the concepts.
- Activities:
  - Creating detailed sketches, 2D/3D models, or CAD designs.
  - Assessing material selection, production methods, and costs.
  - Conducting simulations, ergonomic studies, and mock-ups.
- Output: Refined design concepts with preliminary technical specifications. (Otto & Wood,2001)

4. **Detailed Design:**
- Goal: Finalize the design for production.
- Activities:
  - Developing precise engineering drawings and specifications.
  - Conducting tolerance analysis and selecting materials and manufacturing methods.
  - Prototyping and testing for functionality, durability, and user interaction.
- Output: Production-ready CAD files, detailed technical documentation, and validated prototypes. (Pugh, 1991)

5. **Prototype Development and Testing:**
- Goal: Build and evaluate physical prototypes.
- Activities:
  - Developing prototypes using techniques like 3D printing, CNC machining, or handmade models.
  - Testing the prototype for functionality, aesthetics, and user feedback.

- Iterating based on test results and feedback.
- Output: Refined prototypes and design improvements. (Ulrich & Eppinger, 2015)

6. Final Design & Production Preparation:

- Goal: Prepare for mass production.
- Activities:
  - Finalizing all design details for manufacturing.
  - Collaborating with manufacturers to ensure feasibility and cost efficiency.
  - Establishing a bill of materials (BOM), quality control processes, and assembly instructions.
- Output: Finalized designs ready for production, technical specifications, and manufacturing plans. (Roozenburg & Eekels, 1995)

7. Production and Launch:

- Goal: Manufacture and introduce the product to the market.
- Activities:
  - Scaling up production, monitoring quality control, and ensuring consistency.
  - Conducting pilot runs or small-scale manufacturing for final testing.
  - Launching the product.
  - Output: Market-ready product and a post-launch analysis. (Baxter, 1995)

No matter how many models describe the stages of industrial product design across different designers over time, and despite occasional differences in the names of the stages, all of these models agree on the fundamental steps and stages and aim to achieve the same final outcome. They also align on several key principles, the most important of which are the following:

- ✓ Iterative Process: Product design is often iterative, where feedback from each stage informs the next.
- ✓ Collaboration: Effective product design often involves interdisciplinary teams of designers, engineers, and marketers.
- ✓ Human-Centered Design / User-Centered Design: A focus on the end-user is prime important throughout the process to ensure the product meets their needs.

The intersection of traditional industrial product design process and the User Experience Design Process:

The intersection of traditional industrial product design and the User Experience Design UXD process involves blending physical product creation with a focus on the human-centered digital experience. Both fields share goals of meeting user needs, solving problems, and ensuring functional, aesthetically pleasing results. However, their approaches, methods, and outputs differ in key ways.

1. Problem Solving and User-Centricity:

Both Processes are fundamentally user-centered, but they prioritize different types of user interactions. Industrial design focuses on how users interact with a physical product, while UX design concentrates on users' digital experience. The intersection comes from understanding that whether the product is digital or physical, the end-user's needs and experience must be central.

Human-Centered Design HCD is described by Norman as a design philosophy and mindset that prioritizes understanding human needs. The core principle involves observing users to gain insights into their requirements. One of the most effective approaches is to allow users to interact with prototypes, observe their behavior, and make rapid adjustments to the designs for subsequent testing.

- Traditional Industrial Design: Emphasizes ergonomics, material selection, functionality, and aesthetics to create physical products that are easy to use, durable, and visually appealing.
- UX Design: Focuses on how users interact with digital interfaces, ensuring usability, intuitive navigation, and satisfaction during the digital experience. (Norman, 2013) (ISO, 2010)

2. Design Processes:

The design processes in both fields follow similar phases, although the tools and outputs differ.

- Industrial Design Process: Traditionally follows stages like research, ideation, prototyping, testing, and manufacturing.
- UX Design Process: Includes research, wireframing, prototyping, testing, and iteration, often using digital tools like Sketch, Figma, and Adobe XD.

At their intersection, the prototyping and testing phases align, as both involve creating mock-ups (physical or digital) and testing them with users. In industrial design, prototypes may be physical models, while UX designers create wireframes or digital prototypes. (Ulrich & Eppinger, 2015) (Garrett, 2010)

3. Iteration and Feedback:

Both industrial and UX design rely heavily on user feedback to iterate and refine their designs. In industrial design, this might mean adjusting materials, weight, or form based on user input. In UX design, feedback could lead to changes in interface layout, navigation flow, or responsiveness.

- Industrial Design: Adjusts ergonomics, durability, and user safety.
- UX Design: Refines usability, accessibility, and emotional response.

Both processes benefit from agile, iterative cycles

of design, testing, and refinement. (Brown, 2009) (Nielsen, 1993)

4. Materials and Mediums:

Industrial designers work with physical materials such as plastics, metals, and fabrics, while UX designers work with digital media, such as screens, text, and interactive elements. The intersection comes when physical products incorporate digital interfaces, like in Internet of Things products IoT or smart devices.

- Smart Devices: A smartwatch, for example, blends industrial design (materials, form factor) with UX design (interface design, user interaction).
- Digital Interfaces on Physical Products: like cars with touchscreens or household appliances with application-controlled interfaces, where physical design and digital UX must work seamlessly together. (Moggridge, 2007) (Buxton, 2010)

5. Cross-Disciplinary Collaboration:

The convergence of UX and industrial design is evident in interdisciplinary teams that bring together product designers, engineers, and digital experience designers. These teams work collaboratively to ensure that the physical product and its digital components offer a coherent user experience.

- Internet of Things IoT: Designers of IoT products must balance hardware design with software design. This intersection requires understanding how physical products interact with their digital counterparts to create a seamless user experience. (IDEO, 2015)

6. Emotional and Aesthetic Considerations:

Both fields also pay close attention to how products make users feel. Industrial design might focus on tactile feedback, weight, and material quality to evoke a certain emotional response, while UX design considers how interface elements (colors, animations, typography) create an emotional connection.

- Physical-Digital Blend: In products like Apple's iPhone or Tesla's car dashboard, both industrial and UX design merge to create not just functional products, but ones that evoke emotional satisfaction. (Lidwell, Holden, & Butler, 2010) (Tullis & Albert, 2013)

The intersection of industrial design and UX design is evident in today's tech-driven world, where physical and digital products must work in harmony. As products become more connected and smarter, the collaboration between industrial and UX designers becomes increasingly important. Both fields can learn from each other: industrial designers can adopt more agile, user-centered methods from UX, while UX designers can borrow from the rich tradition of material-focused, physical user interactions.

The Impact of Understanding the UXD Process throughout the Industrial Product Design Practice:

Understanding the User Experience UX process in the industrial product design practice is crucial for ensuring that the final product meets the needs and expectations of users.

- **The key points on the importance of UX are:**

1. Meeting User Needs in UX Design:

The UX process is centered on deeply understanding and addressing the requirements and expectations that users have when interacting with a product or service. These range from basic functionality to deeper emotional satisfaction, encompassing various aspects like:

a. Functionality: Ensuring the product does what users need it to do effectively.
b. Usability: Making the product easy and intuitive to use, which minimizes frustration and inefficiency.
c. Aesthetics: Creating a visually appealing design that resonates with users.
d. Accessibility: Ensuring the product is usable for people with diverse physical or technological abilities.
e. Emotional Satisfaction: Designing products that provide a positive emotional experience, making users feel good when using them.

By focusing on these needs early in the design phase, UX designers can develop products that are intuitive, comfortable, and practical, thus reducing the risk of product failure due to poor usability. Failure to meet these needs can lead to user frustration, inefficiency, and, in some cases, safety concerns, especially in industrial settings (Norman, 2013).

2. Reducing Errors and Enhancing Safety:

In the industrial sector, products are often used in high-stakes environments where mistakes can have serious consequences. A well-executed UX process can help reduce user errors by designing clear, simple interfaces and controls. Ensuring that users understand how to operate the product safely and effectively can prevent accidents and improve overall operational efficiency (Hartson & Pyla, 2012).

3. Iterative Improvement:

The UX process involves ongoing user feedback, testing, and iteration. This continuous feedback loop allows designers to refine and enhance the product over time, based on real-world usage. In industrial design, where products are often complex and used by a wide variety of individuals, this iterative approach ensures the final product is both functional and user-friendly (Garrett, 2010).

4. Increasing Productivity:

UX design improves the efficiency with which users can interact with products. In industrial environments, where speed and precision are critical, well-designed products help user's complete tasks faster and more accurately. This leads to increased productivity and fewer operational disruptions (Baxter, Courage, & Caine, 2015).

5. Long-Term Satisfaction and Brand Loyalty:
When users have a positive experience with a product, they are more likely to trust the brand and remain loyal. In industrial settings, where products are significant investments, a focus on UX can lead to higher levels of user satisfaction, minimizing the need for frequent replacements or redesigns (Nielsen & Budiu, 2013).

In the practice of industrial product design, integrating UX as a core part of the process helps ensure that the product is not only functional but also easy to use, safe, and efficient. By deeply understanding the user experience, companies can create products that stand the test of time and enhance user productivity and satisfaction.

Suggested Industrial Product Design Process Based on User Experience:

The researcher believes that the stages of the design process can be structured as a series of sequential steps, where the order can be adjusted depending on the desired final outcome. This model emphasizes understanding users and their needs at each step, ensuring the product is designed with usability and safety in mind for the design team. Figure 2

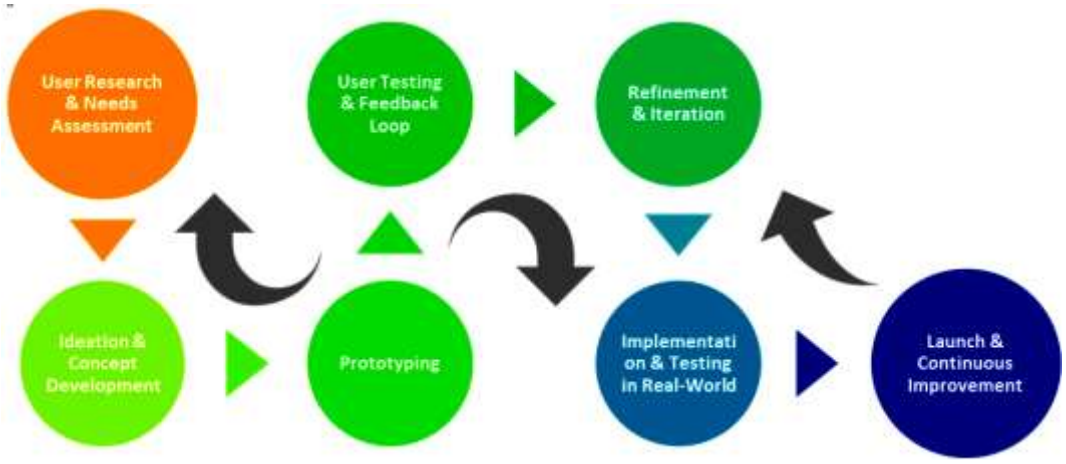

Figure 3 Industrial Product Design Process Based on User Experience

2. **User Research and Needs Assessment:** This involves identifying and gathering information about the needs, preferences, and limitations of the target users.
   - Methods: Conducting personal interviews, surveys, and observing users in their real environments to collect data on their behaviors and the challenges they face.
   - Goal: To understand user expectations for the product, how they interact with similar products, and the pain points they experience.
3. **Ideation and Concept Development:** After gaining a clear understanding of user needs, designers begin developing ideas that align with these findings.
   - Methods: Brainstorming sessions and initial sketches.
   - Goal: To create preliminary designs and concepts focused on how users will interact with the product. Multiple concepts and ideas may be introduced at this stage.
4. **Prototyping:** Various prototypes are created from different materials to conduct early testing on the proposed ideas and present them to a sample of the target users to gauge their satisfaction.
   - Methods: Low-fidelity prototypes (such as paper sketches) and high-fidelity prototypes (such as interactive digital models).
   - Goal: To develop tangible models of ideas to explore functionality and usability, making the concepts more relatable for users.
5. **User Testing and Feedback Loop**: Prototypes are tested with real users to gather feedback on usability, comfort, and functionality. This phase identifies potential issues users may face when using the product. Feedback is collected to refine the design, ensuring that the product is intuitive and meets the needs identified in the initial phase.
   - **Methods:** Usability testing in labs that simulate real-world environments, observing users as they test the prototypes, and using emotion cards to gather user opinions.
   - Goal: To gather feedback on the prototypes to identify problems and areas for improvement.
6. **Refinement and Iteration:** Based on user feedback, the design is refined to enhance

usability, accessibility, and aesthetic appeal. This iterative process continues until the product performs effectively in various scenarios that users might encounter, aligning closely with their expectations and ensuring safety in high-risk environments.

7. **Implementation and Testing in Real-World Conditions:** The final design is manufactured and tested in environments that simulate real-world conditions, and in actual environments by the target users.
   - Goal: This stage ensures the product not only meets design expectations and usability standards but also performs reliably and safely in real-world working environments, ultimately satisfying user needs. Final adjustments are made based on these tests before large-scale production begins.
8. **Launch and Continuous Improvement:** After the product launch, user feedback is continuously gathered to introduce potential improvements or future updates. The product is reviewed post-launch to ensure it remains aligned with user needs and addresses any unexpected challenges.
   - Methods: Ongoing surveys during the product usage period by maintenance teams and after-sales services, or through social media platforms and mobile apps connected to the product's operating systems.
   - Goal: Continuous improvement to provide a smooth, effortless, and productive user experience.

Modern technologies and artificial intelligence tools can also be utilized at various stages to save time and effort for the design team.

Conclusion:

This paper proposes a model that integrates the User Experience Design UXD process into the traditional industrial product design process, offering a structured approach to creating products that are not only functional but also user-friendly and emotionally engaging. By combining key stages from both disciplines such as: user research, prototyping, and testing, designers can ensure that their products meet both technical requirements and the needs of the users. The suggested model highlights the importance of considering user input throughout the design process, from concept development to final production. Implementing this approach can lead to products that are not only well-designed but also intuitive and enjoyable to use, ultimately improving the success of industrial product design in today's competitive market.

Reference:

1. Baxter, K., Courage, C., & Caine, K. (2015). *Understanding your users: A practical guide to user research methods*. Elsevier.
2. Baxter, M. (1995). Product Design: Practical Methods for the Systematic Development of New Products. CRC Press.
3. Brown, T. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
4. Buxton, B. (2010). Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann.
5. Cross, N. (2000). Engineering Design Methods: Strategies for Product Design. Wiley.
6. Ewa, Formation.(06 / 07 / 2023) UX 101 – Development and Implementation. https://formationmedia.co.uk/blog/ux-101-development-and-implementation/
7. Garrett, J. J. (2010). *The elements of user experience: User-centered design for the web and beyond* (2nd ed.). New Riders.
8. Garrett, J. J. (2010). The Elements of User Experience: User-Centered Design for the Web and Beyond. New Riders.
9. Hartson, R., & Pyla, P. S. (2012). *The UX book: Process and guidelines for ensuring a quality user experience*. Elsevier.
10. IDEO (2015). The Field Guide to Human-Centered Design. IDEO.
11. Interaction Design Foundation - IxDF. (2016, June 5). What is Ideation?. Interaction Design Foundation - IxDF. https://www.interaction-design.org/literature/topics/ideation
12. Interaction Design Foundation - IxDF. 2016. What is User Experience (UX) Design?. Interaction Design Foundation - IxDF. [Source]
13. Interaction Design Foundation IxDF. (2016, June 2). What is User Research?. Interaction Design Foundation - IxDF. https://www.interaction-design.org/literature/topics/user-research
14. ISO 9241-210:2010 (on human-centered design principles).
15. Ivanova, S. Lee, J. Jane, K. (September 2024). Iterative Design: A cyclical process of design, testing, and refinement. Article· Recherche Gate.
16. Lidman ADA. Explain UX Design (Or Anything) To Anyone; 2020. Available from: [Source]
17. Lidwell, W., Holden, K., & Butler, J. (2010). Universal Principles of Design. Rockport Publishers.
18. Moggridge, B. (2007). Designing Interactions. MIT Press.
19. Moran, K. (December 1, 2019), Usability Testing 101, Nielsen Norman Group, [**Siurce**]
20. Moustafa, Ahmed. (2023), Integrating User

Experience in Practices of Human-Centered Design Process in Product Design, International Design Journal, Vol. 13 No. 5
21. Nielsen, J. (1993). Usability Engineering. Academic Press.
22. Nielsen, J., & Budiu, R. (2013). *Mobile usability*. New Riders.
23. Norman, D. A. (2013). *The design of everyday things* (Revised and expanded edition). Basic Books.
24. Norman, Don. (2013). *The Design of Everyday Things*. New York: Basic Books.
25. Otto, K., & Wood, K. (2001). Product Design: Techniques in Reverse Engineering and New Product Development. Prentice Hall.
26. Populs´e F. UX DESIGN PROCESS; 2020. [Source]:
27. Pugh, S. (1991). Total Design: Integrated Methods for Successful Product Engineering. Addison-Wesley.
28. Roozenburg, N., & Eekels, J. (1995).Product Design: Fundamentals and Methods. Wiley.
29. Rosala, M. (August 22, 2021), Problem Statements in UX Discovery, Nielsen Norman Group [Source]
30. Tullis, T., & Albert, B. (2013). Measuring the User Experience. Morgan Kaufmann.
31. Ulrich, K.T., & Eppinger, S.D. (2015). Product Design and Development. McGraw-Hill.
32. UXPin, The Guide to Prototyping Process & Fidelity, Ebook.