



BRIDGING
EDUCATION
IN P&O

Design Thinking and Entrepreneurial Mindset: Empowered to Innovate with Confidence



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1. INTRODUCTION

In today's rapidly evolving healthcare landscape, the Prosthetics and Orthotics (P&O) sector stands at the intersection of science, technology, and human compassion. This field has made remarkable strides in enhancing the quality of life for individuals in need. However, to continue making meaningful advancements and improving patient outcomes, students and professionals in the P&O sector must embrace a new skillset beyond traditional clinical expertise. This skillset includes entrepreneurship, design thinking, and innovation. In this introductory section, we will explore why these emerging disciplines are essential for P&O professionals and students.

- **Meeting Shifting Healthcare Needs:** In response to changing healthcare models, P&O professionals must adopt entrepreneurial thinking to identify unmet needs and navigate complex healthcare systems¹.
- **Human-Centric Care:** Integrating design thinking allows P&O practitioners to empathize with patients and create patient-centered solutions², leading to improved patient outcomes.
- **Technology Integration:** Innovation-driven entrepreneurship can leverage advancements like 3D printing, enhancing the accessibility and customization of P&O devices.
- **Culture of Improvement:** Entrepreneurship and design thinking foster a culture of continuous improvement in the P&O sector, challenging norms and pushing boundaries³.
- **Regulatory and Market Mastery:** Entrepreneurs in P&O must grasp regulatory and market complexities to ensure innovation compliance and success⁴.

¹ Suryavanshi T, Lambert S, Lal S, Chin A, Chan TM. Entrepreneurship and Innovation in Health Sciences Education: a Scoping Review. *Med Sci Educ.* 2020 Aug 12;30(4):1797-1809. doi: 10.1007/s40670-020-01050-8. PMID: 34457846; PMCID: PMC8368672.

² Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. *Development Outreach*, 12(1), 29-43.

³ Buhl, A., Schmidt-Keilich, M., Muster, V., Blazejewski, S., Schrader, U., Harrach, C., ... & Süßbauer, E. (2019). Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development. *Journal of cleaner production*, 231, 1248-1257.

⁴ Baines, R., Hoogendoorn, P., Stevens, S., Chatterjee, A., Ashall-Payne, L., Andrews, T., & Leigh, S. (2023). Navigating Medical Device Certification: A Qualitative Exploration of Barriers and Enablers Amongst Innovators, Notified Bodies and Other Stakeholders. *Therapeutic innovation & regulatory science*, 57(2), 238–250. <https://doi.org/10.1007/s43441-022-00463-4>

- **Competitive Edge:** A multidisciplinary skillset that includes entrepreneurship and design thinking enhances job market competitiveness⁵.

This module of Entrepreneurial mindset and Design Thinking, will introduce and explain the steps of the design thinking process, provides methods for each step and tools which can be applied to facilitate each step. Each step is substantiated with a practical exercise to be applied to a scenario, in which a team of educational project designers has set out to develop a new product.

Learning goals:

- Create a consciousness about DT and general processes, to know and understand the module concept, to gain understanding of the practical applications of design thinking
- Understanding what design thinking is and what it is used for
- Reading the texts and watching the video
- Feeling motivated to learn more about design thinking

1.1 DESIGN THINKING CONCEPT

Many changes in our world are driven by innovation. Innovation means to create something new; may it be from already known parts which are assembled in a new fashion, or something entirely new and unknown before. Innovation is present in all fields of our society, it is fuel for economic growth and progress, and provides new solutions to problems and challenges. An important pre-requisite of innovation is creativity, the soil in which new ideas root and flourish.

Design thinking provides us with a systematic and structural approach to solving complex problems from many fields and to find new solutions that meet the needs of those involved. The method is based on a multi-step, agile and iterative process. This design thinking process helps us to narrow down and actually understand our problem, identify solution spaces, and generate concrete ideas. In each step of this

⁵ GLEN, R., SUCIU, C., & BAUGHN, C. (2014). The Need for Design Thinking in Business Schools. *Academy of Management Learning & Education*, 13(4), 653–667. <http://www.jstor.org/stable/43696653>

process, we apply different creative techniques and thus approach innovative solutions for our problem. Users and their needs are always in the foreground.

1.2 WHAT IS DESIGN THINKING AND HOW DOES IT WORK?

Briefly summarised, Design Thinking is a philosophy, combined with a set of tools, to help us solve problems creatively. It is a human-centered problem-solving approach that consists of six phases, each contributing to a holistic and iterative design process (Figure 1).

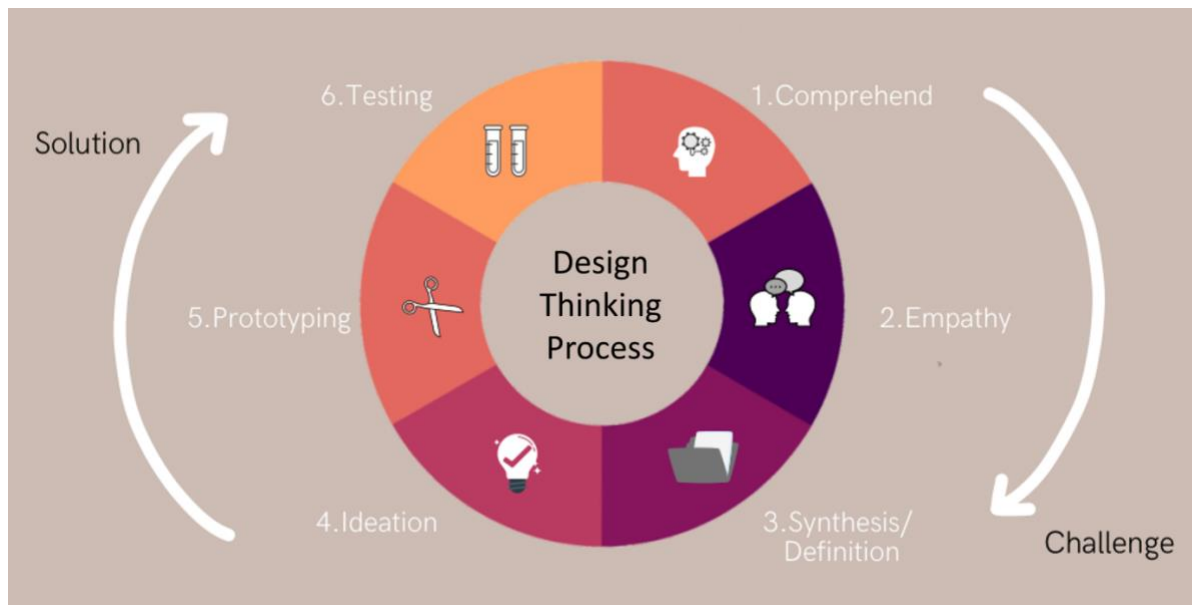


Figure 1. Six Phases of Design Thinking

Overview of the six-phases:

- 1. Understand (Research and Explore):** In this phase, designers delve into the problem by conducting research, interviews, and observations to gain a broad understanding of the context and the user's world.
- 2. Empathize (Understand User Needs):** Building on the understanding phase, designers seek to empathize with users, developing a deep appreciation of their needs, emotions, and motivations.
- 3. Synthesis and Define (Frame the Problem):** With insights from the empathize phase, designers define the problem statement, synthesizing data and user needs to form a clear, actionable problem statement.

4. **Ideate** (Generate Ideas): Next, designers brainstorm and ideate, generating a multitude of creative solutions without judgment to address the defined problem.
5. **Prototype** (Build Tangible Solutions): Designers create low-fidelity prototypes or representations of their ideas, allowing them to quickly test and refine concepts based on user feedback.
6. **Test and Evaluate** (Gather Feedback): Prototypes are presented to users for feedback and evaluation, leading to further refinements and insights to inform the final solution.

You will learn more about each phase in the next chapter.

Additional recourses:

- Design Thinking, explained
<https://mitsloan.mit.edu/ideas-made-to-matter/design-thinking-explained>
- What Is Design Thinking? An Overview
https://www.youtube.com/watch?time_continue=153&v=gHGN6hs2gZY

2. Six Phases of Design Thinking

At the core of design thinking, it's a human-centered framework that empowers individuals and teams to tackle complex challenges by embracing empathy, creativity, and iteration. Central to design thinking are its phases, which serve as a structured roadmap for navigating the creative process. While the traditional model outlines six distinct phases, it's worth noting that some design thinking modules may employ fewer phases, adapting the process to suit specific needs and contexts.

The widely recognized six-phase model of design thinking, including Understand, Empathize, Define, Ideate, Prototype and Test, was popularized by the design firm IDEO and Hasso Plattner Institute. This model has become the foundation for many design thinking methodologies worldwide.

However, it's important to acknowledge that variations exist. Some adaptations, such as the 3-phase model (Inspiration, Ideation, and Implementation), condense the process for simplicity and efficiency. Others, like the 5-phase model (Empathize, Define, Ideate, Prototype, and Test), omit the Implementation phase, focusing primarily on ideation and concept development.

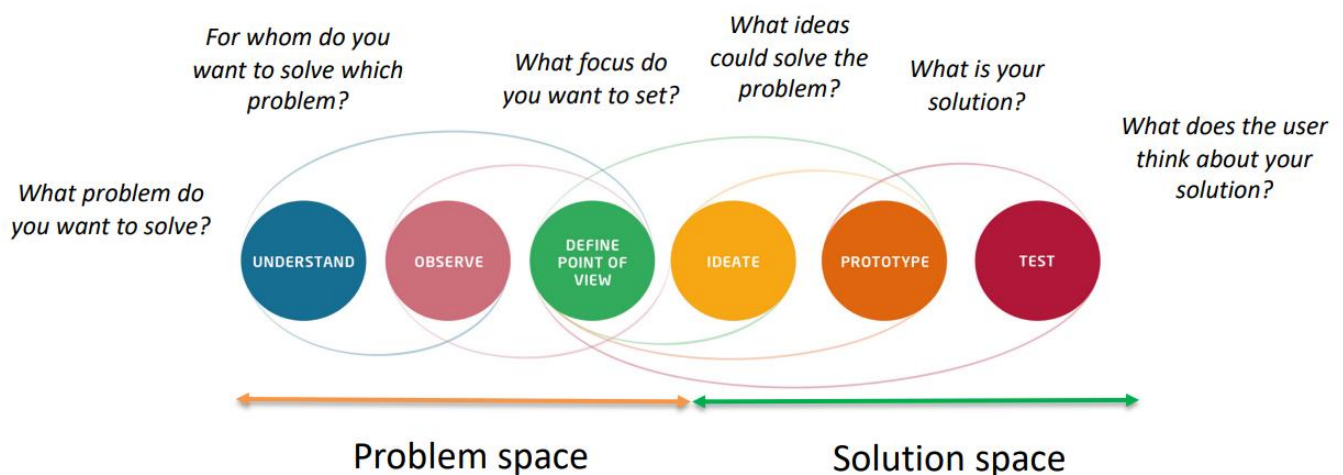


Figure 2 Phases of Design Thinking. Note: Observe is replaced by "Emphasise" in our model

In this chapter, we will explore the six fundamental phases of design thinking and provide a list of tools and methods you can use in each phase.

2.1 UNDERSTAND THE PROBLEM

The Design Thinking Process starts by focussing on the problem or challenge we want to solve. Understanding and identifying the problem is the first step in the design thinking process. It is only possible to sustainably solve a challenge/problem if it is understood holistically. For this reason, uncovering and combining the information is the starting point of the Design Thinking process.

The aim of this phase is to unearth the root causes of an issue, thus, ensuring that solutions address core challenges rather than surface-level symptoms. It aids in problem framing, where a well-defined problem statement sets clear, actionable goals, prevents ambiguity, and fosters shared understanding among team members. Skipping or breezing through the understanding phase may lead to misdirection and costly errors and wasted efforts in subsequent stages as you. Without a solid grasp of the problem, designers risk “answering the wrong question” and leading to irrelevant, ineffective, or misaligned solutions.

In the first phase we focus on the problem or challenges we want to solve. What problem does our client/target group have? We understand the problem. WE understand who our target group is, when the result is needed and why our client thinks they need a solution to the problem. We also take into account the framework conditions that exist in our team/company or that our client has given us.

Tools and Methods

- **Mind Map**

Mind maps are a special form of presenting ideas and information to visualize relationships between them. In short, it's about tying the loose ends together and getting the bigger picture. A mind map is created by the team, either on paper or digitally.

At the beginning, the topic of the map is placed in the centre and marked as a central concept or train of thought. Then everyone writes down everything they can think of related to the issue, firstly individually, then all issues are collected and grouped around the topic of the map. In addition to words, visuals such as icons or pictures can be used. As a tip: If you are working with paper, use individual post-its so that you

can group them later. Finally, arrange and connect the terms with lines and show similarities with colours or symbols.



Figure 3. Mind Map (Image by rawpixel on Freepik)

If you want to use a (free) online tool to create mind maps. This is especially useful if your team works from different places, for further editing and sharing. Here are some mind mapping tools:

- [Coggle](#) for mind map beginners
- [Mindly](#) for mobile mind mapping
- [MindMeister](#) for collaborating on a mind map with a team.
- [Scapple](#) for fluid, non-traditional mind mapping.
- [Stormboard](#) for in-person mind mapping sessions
- [Ayoa](#) for a modern approach to mind mapping
- [MindNode](#) for Apple users
- [SimpleMind](#) for not having to subscribe to anything.

- **Six Questions Method**

The six questions method helps to get a basic understanding of any situation.

The clarification of the questions Who? Why? What? When? Where? and How? support the team in generating a common basis of understanding of the context of the challenge. This procedure is simple, does not require a lot of time and prevents misunderstandings later.

1. **Who?** Identify the people involved.
2. **Why?** Identify reasons that require action and list them.
3. **What?** Identify relevant actions. Create a list of them.
4. **When?** Are there decisive time factors? Gather information about it.
5. **Where?** Write down any places that might be relevant.
6. **How?** Identify how scenarios have worked out in the past and list them.

Task

Scenario: You are a start-up company with a background in the P&O and healthcare background. Your company would like create a solution that would contribution to circular economy and sustainability.

Task: Define your own design challenge by the tools suggested.

Learning goals:

- Understand the relevance of understanding in the design thinking process
- Identify/develop and understand the design challenge
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

2.2 EMPATHISE

In the second step of the design thinking process, "Empathise," the focus shifts to one of the core principles of this human-centered approach: understanding the target groups' experiences, needs, and emotions of the still immature idea. In this phase, we immerse ourselves in the target groups' world, seeking to view, feel, and think as they do. By empathizing with the end-users, we gain insights will guide the entire creative process. This phase fosters a deeper connection with those who will ultimately benefit from the design solutions, unveiling hidden insights and setting the stage for innovative and human-centered solutions that genuinely address their needs and aspirations. In essence, "Empathize" empowers us to embark on a design journey rooted in a comprehensive understanding of the problem and a genuine connection with the people we aim to serve. Other people can also be included, such as bystanders to contribute with views and opinions. The more opinions, emotions, and needs come together, the better and more varied the results are for the further process.

Tool and Methods

- **5-Whys**

5-Whys is a simple and quick questioning technique for a root-cause analysis that tries to get to the "pain point" of a challenge or problem. It helps to deeply analyse a situation, because often the obvious construction sites are not the cause but only a symptom of a chain of problems.

1. Formulate a sentence that describes the current challenge. Make it visible to the whole team.
2. Try to find the answer 'why' this is together as a team.
3. The answer to the question should also be put down in writing.
4. Now, together, transform the previous answer into the next why-question to be clarified.

5. Repeat this step five times until you get to the real pain point.

• **Emotional Journey Map**

The "Emotional Journey Map" technique illustrates the user's journey. The map shows the emotional journey of the user when using a product or service. The focus is on the interaction with the product and on what gets stuck with the users: Does the product satisfy them or not? With this technique, important knowledge can be gathered before prototyping (it can be used in different phases).

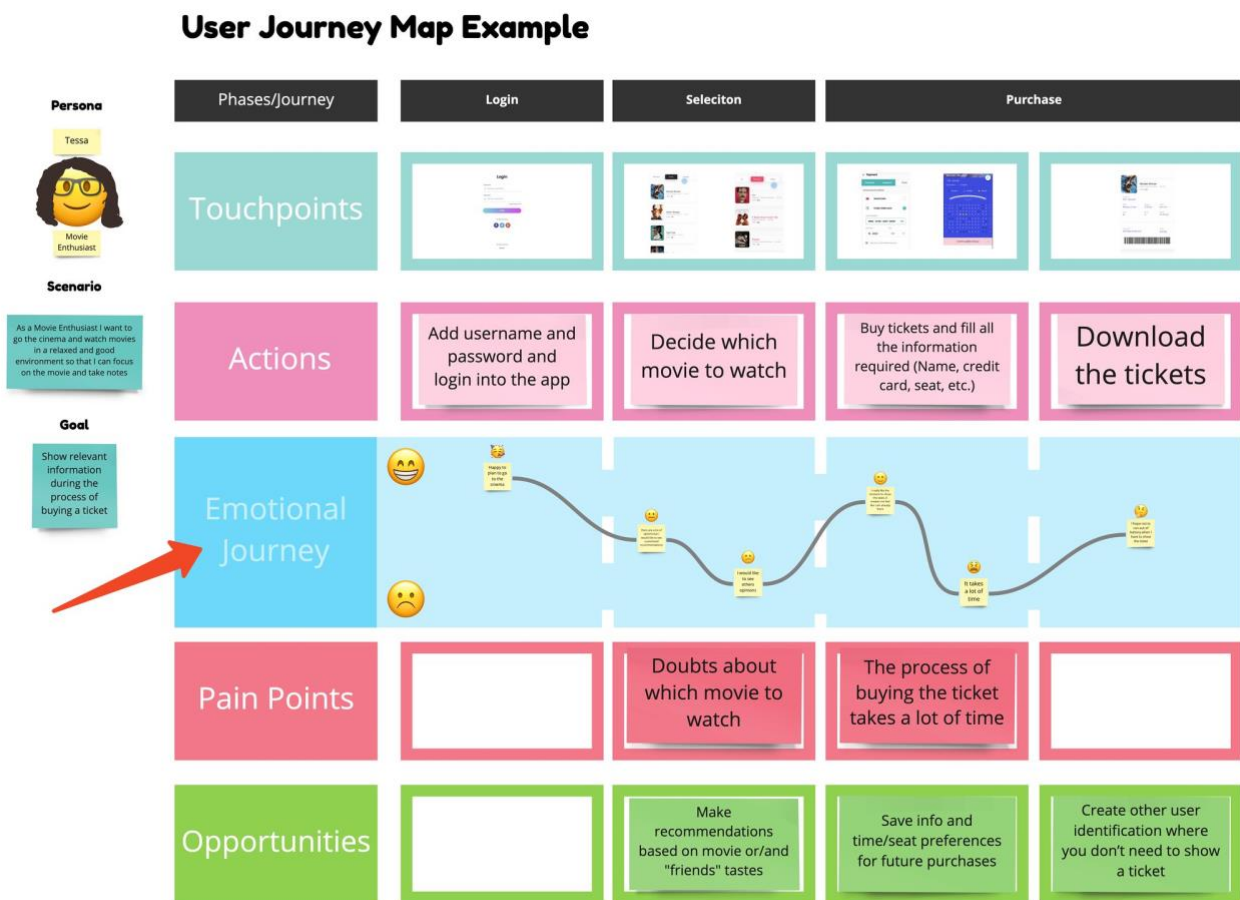


Figure 4. Emotional Journey Map on user's experience of a movie ticket booking app (Source: Calderon & Dimitri, Open Practice Library 2022)

1. Define the activity for which you want to map out the emotional journey. For example, it could be a person's ride on the subway while heading home.

2. Define the course of actions of your type of user within the present scenario.
3. Together determine the high and low points of user-friendliness during the course of action. Research results can also help you at this point.
4. List the evaluation points found individually (you can also use numbers that you assign for the points) and connect them to a line.
5. Look at the low points of the user journey together and think about how you can avoid them.

• Qualitative interviews

Qualitative interviews are very suitable for getting to know potential users and questioning their needs. In the interviews, information about the user and the context should be gathered. It is important that the session is well prepared, including the questions - appropriate to the phase of the design thinking process you are currently in (this technique can be used in different phases).

1. Formulate questions in advance and put yourself in the role of the user: "What concerns the user?"
2. Try to formulate the questions as openly as possible and avoid closed questions with yes / no answers (most of the information is between the lines)
3. Pay attention to what your interviewees say and also question the statements made.
4. Record the information you provide. Use a voice recorder or camera if possible - taking notes yourself takes longer and can distract you.
5. Filter the information after the interview and record the findings and statements that are most interesting for your challenge.

Task

Scenario: After some research and diving in to the various sustainability concerns of the sector, your team notice there is high level of wastage when it comes to

creating orthotics casts, as the main materials are one-time use plaster, fiberglass, which also require a lot of energy and water to produce.

Task: Collect information about your target group's habits and needs by using one of the tools suggested.

Learning goals

- Understand the relevance of the empathy phase in the design thinking process
- Identify stakeholders and understand their perspectives and needs
- Understand the potential users' propositions and needs regarding the aspired solution/product/idea
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

2.3 SYNTHESIZE AND DEFINE

In the third phase, we summarise and combine our most important findings and knowledge from the first two phases (Understanding and Empathise). Synthesize and Define is a critical juncture where the diverse insights and ideas gathered in the previous stages are distilled, refined, and structured into a coherent and actionable framework.

What insights can we gain? We share our knowledge within the team. We interpret our previous analysis and draw new insights and weigh the findings. The picture of our users clearly increases in detail. The main goals are to identify patterns, common themes, and the root causes of the problem. This analytical approach helps distil a wealth of data into key insights, revealing the core issues that need to be addressed.

The aim of this phase is to share the knowledge with our team and to generate tangible findings. We summarise our findings in a persona, for example. The persona represents our user group with its needs and allows us to feel empathy in the generation of ideas in the next phases of the Design Thinking process. We finally conclude this phase with a How Might We question.

Tools and Methods

- **Personas**

Personas are useful when the context or users are not sufficiently known. They are representations of fictional people who represent potential types of users of your idea, product, or service. They are designed on the basis on information gathered in the previous phase, through research or interviews with the target groups. The creation of personas helps the DT team to gain a greater understanding and empathy for the users and to be able to further develop the project according to the needs and preferences of users.

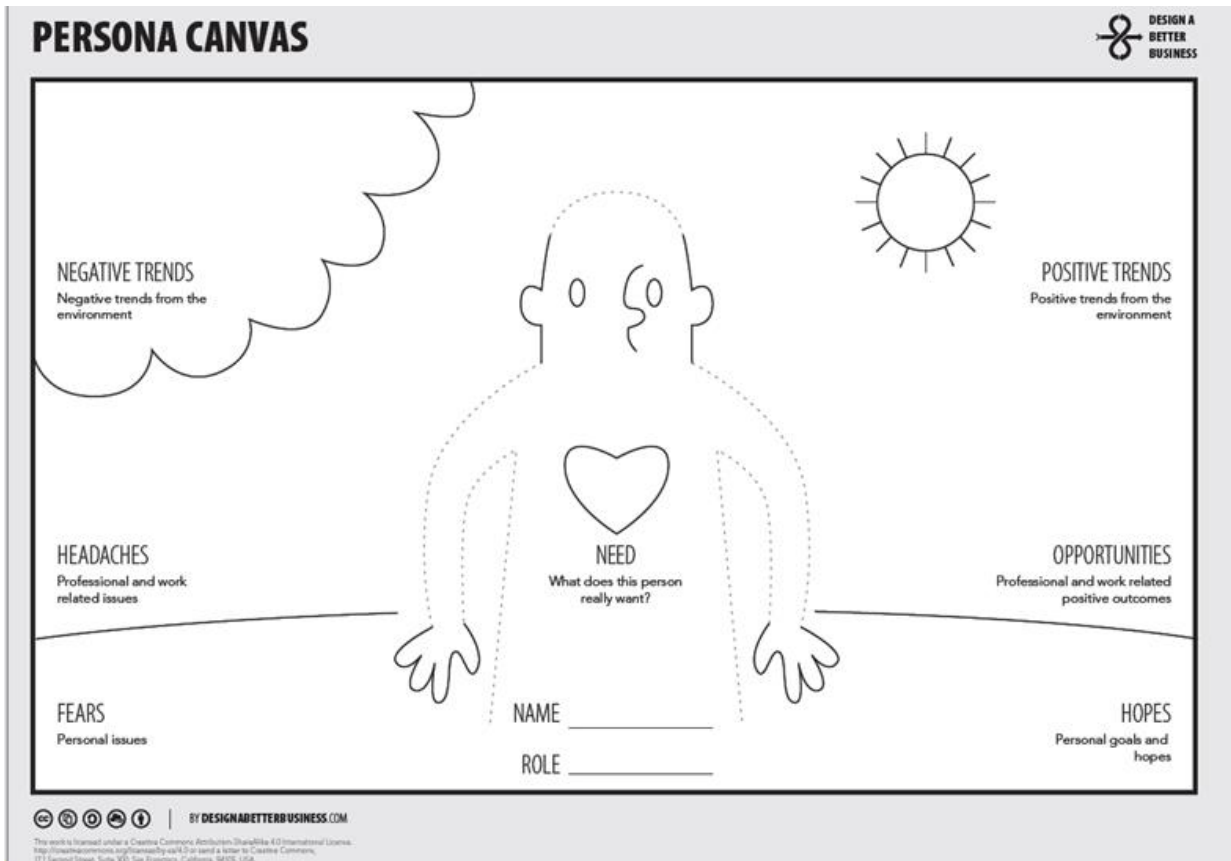


Figure 5. Example of a Persona Canvas, a tool to help to better understand and represent the target group. (Source: Design a Better Business)

1. Understand your key audience. This can include data collected and gathered by yourself (e.g., through interviews) or draw on information from market research
2. Divide then the fictitious users into individual groups and filter their specific needs from the preliminary information
3. Create one or more personas based on the groups and try to avoid stereotypes. A bit of imagination is required at this point

Task

Scenario: After gathering more information and understanding on your target groups, your team is at a junction to structure all the findings from phase 1 and 2 and to better synthesize, define and frame your problem/challenge that your start up want to address.

Task: Bring together all findings you have had so far and conclude their relevance with the use of persona canvas(se) of your client(s). You should also create a problem/mission statement to summarise and give focus to your team.

Learning Goals

- Understand the relevance of the synthesis phase in the DTP
- Understand the connections and priorities of information regarding the aspired solution/product/idea
- Identify and understand the aspired client via a persona
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

2.4 IDEATE SOLUTIONS

In the fourth phase of the design thinking process, known as "Ideate," our primary goal is to generate a wide array of ideas and potential solutions. We draw upon our collective knowledge and creativity to brainstorm as many ideas as possible, emphasizing quantity over quality at this stage. Our approach is to explore various creative techniques to create a fertile ground for innovation.

As the team starts to generate more and more ideas, we recognise that not all will be equally valuable and some ideas will be very similar. It is then important to cluster and prioritize among them. We might use methods like the Wow-How-Now technique. The aim is to reach a consensus on one or two ideas that hold the most promise and align with the problem we've defined. These selected ideas will move on to the next phase for testing and validation.

Ideation serves as a transition into the "solution space," where we channel our creativity to craft solutions tailored to the personas we've identified earlier in the process. It's a dynamic phase where we focus on generating and exploring ideas that have the potential to address specific user needs and challenges effectively.

Tools and Methods

- **Brain Writing**

Brainwriting method can be used as an alternative or as preparation for classic brainstorming. In contrast to brainstorming, in which an open discussion arises from the start, the participants initially collect their ideas in silence just for themselves. Then each person can present the points they have collected to the group. The goal that every person has their say (not just the extroverts), can be easily achieved with this method.

1. At the beginning it is necessary to formulate a concrete question, if it is not already there (e.g. "How can we ...?")
2. Then each person in the group formulates some ideas on post-its. This process should be done in silence and with a timeline. It also makes sense to set the maximum number of post- its or ideas per person (e.g., 5 per person) in order to also limit the time for the subsequent presentation and discussion.

3. After the actual brainwriting process, the ideas become visible to everyone presented in the group and clustered if possible. At this point, the method can flow smoothly into an open brainstorming session

- **Bodystorming**

Bodystorming is very reminiscent of the brainstorming method. The difference lies in not only discussing a (fictitious) challenge or question, but also physically empathizing with the situation. In this way, the actual perspective of the potential user is taken and understood. In this way, the ideas can be developed in a more targeted manner.

1. Think in advance where the situation should be examined more closely.
2. Go there with your DT team and observe the behaviour and interaction of the users
3. Record everything that influences the actions (e.g., the framework conditions). You can take notes or film the situation (videos are ideal for analysing the situation later)
4. Determine team members who, taking into account the knowledge gained, put themselves in the situation as "users" and act out the situations
5. Analysis of the findings: Ask the team members about their subjective experiences and feelings during the re-enactment

- **Bisociation**

The method of bisociation or also stimulus image or stimulus word technique describes the creative process of generating ideas in which images or terms from unfamiliar areas are combined with one another. The technique is ideal for breaking through established thought patterns and finding completely new approaches.

1. The DT team looks at pictures, words, or videos that at first glance have nothing in common. It doesn't have to be stimuli from one category only. It is also possible to use a combination such as photos and words. Ideally, the group analyses two stimuli, especially if the technology is new to them (maximum five)

2. Then the team members individually note which associations the stimuli trigger in them - of course in relation to the original challenge
3. In the following brainwriting phase the new ideas were collected and discussed in terms of potential and feasibility.

- **Wow-How-Now**

The Wow-How-Now method is suitable when the process of collecting ideas is largely completed and you need to set priorities. The ideas collected are evaluated according to their originality or innovative strength as well as on the basis of their feasibility and entered into a matrix. In this way, the team can decide which ideas to select to continue the process.



Figure 6 Wow-How-Now-Ciao Matrix

1. The DT team draws a two-axis matrix (2x2).
 - a. The Y-axis is referred to with the term originality,
 - b. the X-axis with feasibility.
2. The field at the top right is labelled "How" (the originality is high, but it is difficult to implement); "Wow" follows at the bottom right (the originality is high, so is the feasibility - the best ideas will be found here later); "Now" is written at the bottom left (the originality is low, but the feasibility is feasible - short-term measures can be collected here). In the field at the top left, ideas are

written down that are neither original nor feasible - they will not be used for the rest of the process, so you can say “Ciao”.

3. Be sure to discuss these decisions in the team.

Task

Scenario: Now that your team has identified and defined the problem of that you want to solve, you need to come up with possible solutions.

Task: First, generate ideas for solving your design challenge in a user- centred approach and then prioritise and select 1-2 ideas. Use the tools listed above to guide you in the process.

Learning Goals

- Understand the relevance of the ideating phase in the DTP
- Understand the connections and priorities of information regarding the aspired solution/product/idea
- Identify a number of ideas that are feasible to solve the problem/design challenge
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

2.5 BUILD A PROTOTYPE

In the fifth phase of the process, we bring our idea(s) identified in the previous phase to life. Now our solution is made tangible. How do we visualise the idea?

The goal is to test the solution with our users and gain new feedback and further insights. We focus on creating prototypes as quickly as possible and with little effort. The prototypes are continuously adapted based on feedback from our customers. At the beginning, a sketch or a handcrafted element is often sufficient. A wide variety of materials can be used for this. Examples of analogue models include paper, modelling clay, and building blocks. Digital tools can be used just as well, for example to display an app or to realize an object with the aid of a 3D printer - there are no limits to creativity!

The fifth phase of the process is a very important one, but also one of the funnier. In prototyping, the thoughts and ideas previously developed are translated into a tangible product. A wide variety of materials can be used for this. Examples of analogue models include paper, modelling clay, and building blocks. Digital tools can be used just as well, for example to display an app or to create an object with the aid of a 3D printer - there are no limits to creativity! The aim is to create a prototype that can be used to obtain feedback.

Forms of Prototypes

- **Paper prototypes**

Simple prototypes made of paper, for example, are used to represent the essential characteristics of a product or service in a simplified manner. It's not about showing the full range of functions, but about illustrating the solution for potential user groups through a paper model of the product. Since it is only about a basic understanding and the interaction with the object, we consciously work with simple means.

For creating a paper prototype, you can use these materials:

- Paper and processing tools (e.g., scissors, glue, colours)
- alternative materials such as clay or blocks, plaster, etc.

Proceed like this:

1. Identify and define the essential criteria and features of the product or service idea
2. Then consider which material is best suited to depict your idea in an abstract and reduced form
3. Model the prototype with the help of suitable materials (e.g., paper, clay, building blocks, wood, etc.)
4. Go out with your prototype and show it to different people you meet (by chance). Show the people the essential characteristics and collect feedback (note the feedback)
5. Document the results of the feedback and possible discussions and use these findings for the further development of the idea.

• Role Play

For the role play method, one or more (ideally) uninvolved persons simulate a situation with the developed idea. Through the role play, on the one hand, the uninvolved people should have a realistic user experience with the prototype, and, on the other hand, they should provide the DT team with a gain in knowledge. The degree of specifications and improvisation for the scenery can be determined individually.

1. Identify and define the situation to be analysed and then determine the people involved as well as the framework for the action
2. Then the roles are allocated to the uninvolved or performing persons
3. While performing the role-play, pay attention to your script but be open to it other, spontaneous courses of action
4. After the role play, document and discuss the results and the resulting feedback loops.

• Storyboard

Storyboards are another form of prototype that visualizes an idea through a sequence of photos, sketches or collages or shows the user experience with the prototype. The form of representation helps users to understand the context and can also stimulate discussions.

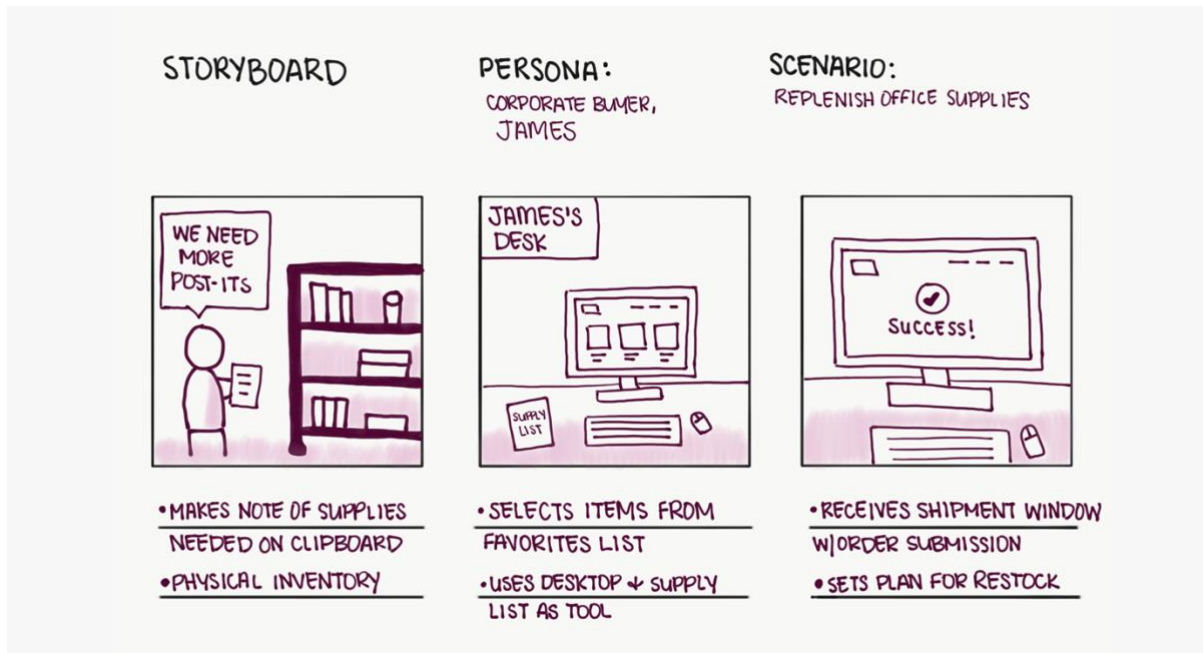


Figure 7. Example of Story Board..(Source: Rachel Krause 2018)

To design a storyboard, you can either use plain paper or pre-formatted templates (link provided below).

1. Specify together the topic and the message that you want to represent through the story and then create roles for your story.
2. Then write the story down briefly in bullet points like a script and divide it into suitable sections or scenes. Limit yourself to c. 4-12 scenes here converts images.
3. Decide together how you want to represent the story (e.g.. Drawing, digital graphics, etc.).
4. At best, use a storyboard template (digital or printed)
5. The storyboard can then be used to explain the purpose of your project or serve as a basis for discussion with users.

Templates:

<https://boords.com/storyboard-template>

<https://www.canva.com/create/storyboards/>

Task

Scenario: After the ideation phase, your team came up with an idea to create an alternative, re-usable and environmental friendly material as an alternative to plaster casts.

Task: Build a prototype of your idea by using one of the methods presented above.

Learning Goals

- Understand the relevance of the prototyping phase in the DTP.
- Identify and highlighting key features of the product/idea in a prototype
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

2.6 TEST AND EVALUATE

In the final phase of the design thinking process, we take the prototype we've developed and put it to the test with our clients or users. This step is all about gathering qualitative feedback from those who will ultimately use our solution. We aim to understand their perspectives, uncover their needs, and determine whether our prototype effectively addresses the problem at hand.

Our goal is to continue refining and developing our idea until our clients or users recognize it as a viable solution to their challenges. Testing is essential in evaluating whether our solution aligns with the needs and expectations of our users. For instance, we may employ methods like card sorting to evaluate the usability and arrangement of features within our product or service. Ideally, external individuals who are not directly involved in the project evaluate our offering. Their unbiased feedback is invaluable.

This final step in the design thinking process is significant but also challenging, as it requires seeking feedback from external, uninvolved individuals. We venture out with the prototype, engaging with unknown people to gather insights on how our idea and its implementation are received. What can be improved? What do potential users desire? These questions guide our feedback-seeking efforts.

It's essential to understand that the design thinking process doesn't conclude here. Instead, it enters into an iterative loop where feedback continually contributes to the refinement and enhancement of the prototype. This ongoing cycle ensures that our solution evolves in response to real-world feedback, ultimately resulting in a more effective and user-centric product or service.

Tools and Methods

- **User Test**

User tests are used to have prototypes tested by selected users. All or only part of the functionality can be made available. When operating the prototype, undiscovered potentials but also possible weak points become apparent. The simple user testing can be carried out in different stages of development in order to incorporate feedback.

1. Show the users your prototype, as best as possible without further explanations, in order to get a first unfiltered opinion. If the idea is not self-explanatory, just explain the context, which is needed for further understanding.
2. Let your users report during the testing what they are doing and how they experience the application.
3. Observe the processes carefully and do not intervene in any way.
4. During the testing and / or afterwards, asks you valuable questions such as “Would you use the product / service? And if so, why, or why not?”

• Capture Grid

The Capture Grid offers the DT team the opportunity to note and cluster all findings from the user tests. The 2x2 matrix lists all aspects that have been understood well or badly, as well as ambiguities and new ideas. The classification into the four areas helps enormously with the structuring.

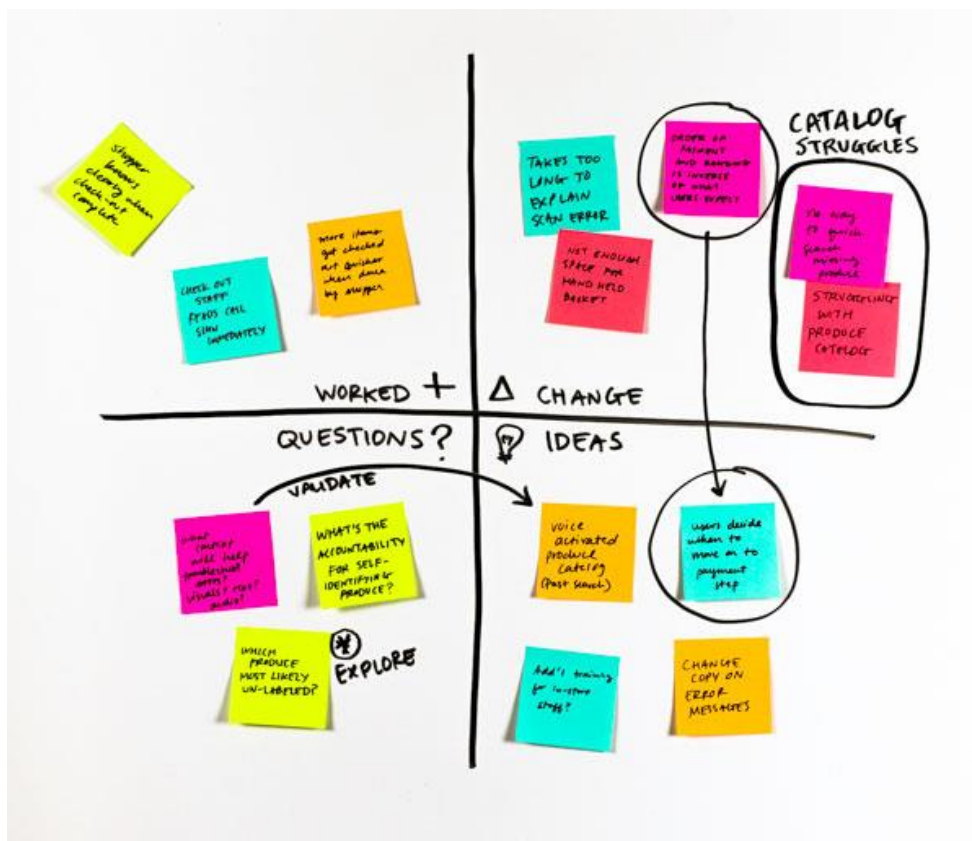


Figure 8. Capture Grid Example (Source Enterprise Design Thinking Toolkit, IBM 2018)

1. Sketch the 2x2 grid (matrix) on a whiteboard (manual or virtual)
2. At the top left there are positive aspects, at the top right negative aspects. At the bottom left, ambiguities/questions are listed. And at the bottom right new ideas that arose during the testing.
3. Start the testing and transfer the findings as directly as possible to the feedback grid.
4. Discuss and checks the grid after each test run the users and, if necessary, add further aspects
5. The grid can be added to or modified by further testing

Testing Card

The preparation of a testing card helps you to prepare an optimal test scenario for your prototype. Specific questions are collected on the card that relate to the prototyping object and its application in the test. In this way, the goal is kept in view when interacting with the potential users. In addition, the tests are so well prepared that the knowledge gained can flow directly into the further development or finalization of the project.

1. Together, think about questions that reflect the essential factors of your project (and what you want to check). For example, ask yourself what kind of feedback do you need for the next steps ?, Who is your ideal user? Which scenario should the users put themselves into during testing ?
2. Write down the final questions and comments for the users on your testing card. It is also helpful if you can describe your prototype in one sentence. So, you can "pick up" the users at the beginning.
3. Go through the questions yourself after completion to adapt or expand them if necessary.
4. Then carry out the tests using your prototype and your testing card and document the results for further development.

- **Wizard of Oz Prototype**

The aim of the method “Wizard of Oz prototype” is to save unnecessary time and financial resources. Instead, the need for individual functions is checked in advance. In this way, the user only tests a simulation of the planned range of functions, which leads to valuable feedback.

1. Think carefully about which functions of your prototype should be tested
2. Then think about how and with which tools you can simulate this range of functions as realistically as possible (a combination of tools is also possible at this point)
3. Carry out the tests calmly and observe the user behaviour without commenting on it
4. After the testing, you can find out about the user experience in discussions and collect further feedback.

Task

Scenario: Now that you have create a prototype of your solution, it is time to test and gather external feedback.

Task: Create a testing scenario for your prototype by using one of the methods above. If testing is not possible to real client/users, present your prototype and test it with your peers to gather external feedback.

Learning Goals

- Understand the relevance of the testing phase in the DTP
- Understand the connections and priorities of information regarding the aspired solution/product/idea
- Identify and understand whether the solution is feasible or if a new idea needs to be developed
- Apply methods from the design thinking toolkit
- Engage with the task, being motivated to solve it

3. Conclusion

The integration of a Design Thinking module within the Prosthetics and Orthotics (P&O) sector represents a significant leap forward in transforming how students and professionals approach challenges in this field. Design Thinking equips them with a versatile problem-solving toolkit that emphasizes empathy, creativity, and iterative processes.

Through this module, you should not only gain valuable insights into understanding the complex needs of patients but also learn how to develop innovative, user-centered solutions. This holistic approach fosters a culture of continuous improvement, where the emphasis is on developing not just functional but truly impactful prosthetic and orthotic devices.

Moreover, the adaptability of the Design Thinking framework allows for tailoring the process to specific P&O challenges, ensuring that solutions are practical, relevant, and responsive to the ever-evolving needs of patients. It encourages collaboration, breaks down silos, and opens doors to interdisciplinary teamwork, which is crucial for addressing complex healthcare challenges effectively.

As we continue to advance in the Prosthetics and Orthotics field, the Design Thinking module serves as a catalyst for driving innovation and elevating the quality of care provided to patients. By nurturing a mindset of empathy and creative problem-solving, this module empowers individuals to not only meet the needs of today but also anticipate and shape the needs of tomorrow, ultimately leading to improved patient outcomes and a brighter future for the P&O sector.