

The Exploration of Product Performance Photography in New Product Development (Npd) Activity: A Design Thinking Approach

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Abstract

Photography is a distinctive medium that can be used to research the product design problem and develop new development strategies. This study uses a Design Thinking (DT) approach to explore product performance photography in New Product Development (NPD) activity. Product performance photography can provide valuable insights into user behaviour and preferences, helping designers and engineers to develop more innovative and effective products. The design thinking approach emphasises a human-centred approach to design, prioritising empathy, experimentation and iteration. Through user research and analysis of product performance photographs, NPD teams can identify areas for improvement and develop new design concepts that understand the target audience and their needs. This includes interviews, surveys and observations to gather insights into user behaviour, preferences and pain points. This study provides empirical data that presents photography's influence on product design development. The design guidelines were summarised accordingly by analysing images taken while the quality of the product designed can be enhanced. The study also provides evidence to support the interactionist theoretical framework when describing the meaning attribution process to product forms. Knowledge gained from the study is beneficial for product designers when communicating clearly with users via product forms and as a result, achieving commercial success.

Keywords: Product Performance Photography, New Product Development, Photography, Design Thinking

Introduction

The ability to observe and reinterpret the world, reality, is crucial in a society that increasingly relies on visual means of communication. Imagine, rediscover, and construct alternate worlds from behind the lens. The idea, the conceptual component, and the technical image, the result, of a photograph can cause us to question the very universe (world) supported by the image. Numerous tools are being developed to assist designers in product design

development. Computer-aided design (CAD), photographs and sketches are always represented to minimize design fixation and maximize idea generation. A comparative study has been presented that offers insights into how these various representations may be used in examples during idea generation. Olufunmilola A. and Julie L. (2015) indicate that analogical databases of compelling design examples should include CAD and photolike images of the analogue rather than sketches. Regarding the designer workflow, the research literature shows that photography is vital in providing empirical data in product design development. In their recent study, Jane E.M., Emily M., and Charlene D. (2021) uncovered innovative applications of photography that contribute to the understanding of complex problems and the generation of effective solutions. It shows how to use photography in the design of new products successfully. Jane E.M. adds that using photography as a research tool raises practical and ethical concerns. Future research should look into photography as a tool that can be used throughout the design thinking process.

The exploration of product performance photography in New Product Development (NPD) activity, using a design thinking approach, involves leveraging photography to enhance the understanding, evaluation and communication of a product's performance during the design process. Product performance refers to the ability of a product to meet or exceed the expectations and requirements of its intended users or customers. It encompasses the overall functionality, reliability, quality, efficiency, durability and effectiveness of a product in delivering its intended purpose. The performance of a product is typically measured against specific criteria or metrics, which may vary depending on the nature of the product and the industry it belongs to. These criteria can include factors such as speed, accuracy, capacity, power consumption, user experience, safety and compliance with regulatory standards.

This approach integrates visual representation with the iterative and user-centric nature of design thinking to create better products. Design thinking is a human-centered approach to problem-solving that emphasizes empathy, experimentation and iterative design. It involves understanding user needs, generating creative ideas, prototyping and testing to refine solutions. Incorporating product performance photography into this process can provide designers with valuable insights and benefits.

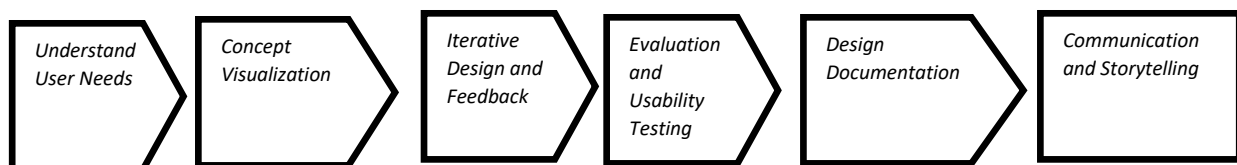


Figure 1: Key Points Related to the Exploration of Product Performance Photography in New Product Development Using A Design Thinking Approach

Figure 1 shows some essential issues about the use of product performance photographs in new product development utilising a design thinking approach. Product performance photography is a valuable tool for understanding user needs, as it allows designers to capture real-world scenarios and user interactions, providing insights into their preferences, pain points and requirements. It enables designers to inform the design process by observing and documenting how users interact with existing products or prototypes, allowing them to prioritize user-centred features. Photography also aids in concept visualization, enabling effective communication of design concepts and ideas to stakeholders, clients and team members. Designers can foster collaboration and achieve a shared understanding of design concepts through visual representations. Moreover, photography supports iterative design

and feedback, capturing a design's evolution over time, facilitating the evaluation of changes and gathering feedback from users and stakeholders. It plays a crucial role in usability testing and evaluation by documenting user interactions, emotions and experiences, helping identify areas for improvement.

Additionally, photography is a research tool that has the possibilities for future references for the design process and decisions made, thereby contributing to a comprehensive archive and facilitating knowledge transfer. Lastly, product performance photography aids communication and storytelling, allowing designers to showcase the product's features and benefits in real-life contexts, creating persuasive narratives that resonate with users and stakeholders. In conclusion, integrating photography into the design thinking approach enhances the exploration of product performance in new product development, leading to user-centred, impactful and successful products.

The Contributions to this Issue

Four papers explore the potential and possibilities for future references using photography as a research tool. The diversity of approaches in photography approach becomes visible in Hubert Knoblauch's (2008) paper. In the social sciences, photography as a research tool has grown significantly. In addition to sociology, criminology, health and nursing studies, educational research, human and cultural geography, media and cultural studies, discursive and social psychology, management and organization studies, political science and policy analysis, photography as a research tool has established roots in many major fields of study. New methodological approaches are being created and anticipated for the near future due to the rapid growth of information technology, making it easier to create and edit digitized data and use computer-based procedures to store and manage visual data. Researchers from several fields of the interpretive social sciences present some significant and promising techniques in this issue.

It is possible to make educated predictions about what occurred in the past through the use of photographs. Forensic photography is an example of how photography may also be used to predict flaws or as a temporarily halted activity. Sanjay Murgod (2018) sees the role of photography in forensic is indispensable in documenting, preserving, analyzing and presenting evidence in criminal investigations. It helps ensure accuracy, transparency and reliability in the justice system. With the proper selection and installation of relevant photography and computer equipment, as well as the requisite training and workflow patterns, introducing photography into the field of forensics becomes an easy attainable aim. The function of the forensic photography is critical, as adequate evidence documenting requires good photography skills as well as up-to-date knowledge of the mechanics and techniques involved. Photographs are used to reconstruct the sequence of events at a crime scene. By capturing various angles, distances and perspectives, forensic photographers aid investigators in piecing together how the crime occurred, the movements of individuals, and the interactions between objects and people involved.

Jane Emma Machin (2021) elaborates on the potential of a critical review of research using photography to examine the complex physical, emotional, psychological and social relationships individuals have with food at personal and societal levels. Photography is a uniquely inclusive and accessible research method for understanding the social problem of food well-being and designing innovative food experiences. This paper provides the first conceptual foundation for the use of photography in design thinking. Jane identifies novel photographic methods that can be used to understand problems and generate solutions. It

provides guidelines to successfully integrate photography in the design of innovative food experiences that improve food well-being.

In the fourth contribution, Magda Wieteska (2018) discussed that photographic materials could be considered factual material. Photography is regarded as excellent study material. The materials can be interpreted and analysed to reveal social microcosms, infer specific social occurrences, and recreate personal narratives. It can also be used to examine how social processes present themselves (Atkinson, Delamont, 2010). Research methodologies incorporating visual elements are necessary to live in an image-driven culture. As a result, there are also particular approaches for the presentation and interpretation of data, as well as research results that are based on visual imagery, according to Krzysztof Konecki (2005). Furthermore, photography can be a perfect research material whose interpretation allows for qualitative reconstruction of the personal world of the subject being analysed (Jurczyk-Romanowska, 2013). It is also a form of artistic expression, and “science, as well as art, are essential parts of culture and thus areas of human life” (Pryszmont-Ciesielska, 2015, p. 98). Visual materials in social sciences may also be therapeutic (Jurczyk-Romanowska, 2013; Pryszmont-Ciesielska, 2015). Visual materials can also be considered factographic materials, the analysis of which provides new knowledge about given social phenomena (Kaczmarek, 2004).

Overall, these papers collectively demonstrate the wide-ranging applications of photography as a research tool, highlighting its potential for capturing and understanding diverse aspects of human life and society.

1. Photography as a Research Tool

Photography is a distinctive and effective method to research the product design problem and develop new development strategies and photography is one of the fundamental approaches. According to Wallenbäck and Karin (2011), photographs are considered an integral element of the design process rather than merely serving as a form of project documentation.

Using photography, K. Konecki (2005) differentiates four principal study methodologies. The first is photographing as the researcher's direct, planned action, which is then exposed to the later analysis of the induced materials. It is commonly utilized in field studies. The data is then triggered, which means the researcher takes images (of items, people and events) to gather specific visual materials. As a result, in this instance, theory takes precedence over investigation, which may result in empirical evidence not yielding new theories. In order to prevent such a situation, the researcher should ask questions during the research and search for answers using photography.

In contrast to the method of using photographs in interviews, which acts as a research instrument, the photographic theme list is used when photography is the subject of the study. The second study approach relies on using photography as existing materials or photographs created by someone other than the researcher, such as the participant's auto photographs. Therefore, taking pictures is not a research approach; the strategy is gathering and interpreting data. It needs the researcher's ability to control the exact outcomes that might be attained through the first technique, which entails the researchers taking their images.

The third method combines photographs with the respondents' narratives based on their responses to the photographs given to them. It matters where the visual materials are displayed in this case. Depending on the situation, the same image can elicit various responses. According to Konecki (2005), respondents react differently to the same

photograph when it is shown in a museum and when it is used as a text illustration in a newspaper. Direct contexts, which include the presenting location and its immediate surroundings, are the settings in which the material is presented. When a context definition is inadequate, it is expanded by the observations and experience of the observers, allowing the development of an extended context and the reading of meanings.

The final research technique involves employing photography to illustrate study findings or support them when verbal texts or numerical data constitute most of the empirical data (Konecki, 2005). In this case, the photos showed support or expanded the research's findings and served as portraits or illustrations of critical ideas. For instance, anthropological literature sometimes includes pictures of the rites or customs of the many civilizations that have been investigated.

Another aspect of the role of photography that influences how users view a product is that it can be classified into one of three categories: aesthetic, referential or communicative. Each of these categories can be analysed separately. At the aesthetic level, the focus is on the form and visual appeal of the photograph itself. This includes composition, lighting, colors and overall aesthetic qualities. The photograph's aesthetic level influences the product's initial impression and attractiveness, which can shape consumer perception. Aesthetics and image quality are often correlated.

Moving to the referential level, attention is directed toward the photograph's content. This involves examining the objects, subjects or scenes depicted in the photo and how they relate to the product being showcased. The referential level of the photograph can convey information about the product's features, functionality, and context of use. It helps consumers understand the product's purpose and how it may fulfill their needs or desires.

Lastly, the communicative level focuses on the meaning or message conveyed by the photograph. Beyond the visual elements, it considers the symbolism, emotions, and associations evoked by the photo. The communicative level of product photography plays a crucial role in shaping consumer perceptions, as it influences how consumers interpret and attribute meaning to the product. A photograph can evoke emotions, establish brand identity or communicate values, affecting consumers' attitudes, preferences and purchase decisions. Muller (2012) asserts that a captivating image should catch customers' attention, consciously or subconsciously, and motivate them to engage with it. To achieve this, there are numerous techniques available to photographers that can be employed to create photographs that elicit attention and evoke the desired emotions from viewers. These techniques include careful composition, strategic use of lighting, selection of visually appealing colors, incorporation of dynamic elements and compelling storytelling through visual narratives. By utilizing these techniques, photographers can craft images that draw the viewers' gaze and resonate with them on a deeper emotional level, driving them to interact with the photograph and the product it represents.

Furthermore, photography is a valuable research tool for exploring product performance in the context of new product development activity. When integrated into a design thinking approach, photography can provide rich insights, facilitate user engagement and enhance the overall design process. Figure 2 shows the influencing factors between User Experience (UX), Design Thinking (DT) and New Product Development (NPD).

UX refers to the overall experience and satisfaction when interacting with a product. It encompasses all user interaction aspects, including perceptions, emotions, preferences and behaviors. NPD always refers to conceptualizing, designing and bringing a new product. It involves all the activities and stages from the initial idea generation to the product's final

launch. Here comes the close link, which plays a crucial role in creating successful and innovative products because UX and NPD are interconnected. Both UX and NPD emphasize the importance of a user-centered approach. In NPD, the process involves identifying user needs, preferences and pain points and designing products that address those factors. UX design focuses on understanding user behaviors, motivations and goals to create intuitive and satisfying experiences. By incorporating UX principles and methods into NPD, it can ensure that the new product meets user expectations and provides a positive experience. By incorporating photography into the UX and NPD processes, it can leverage visual insights, enhance visual design, communicate effectively and create an engaging user experience for new products. It helps bridge the gap between the design intent and the user's perception, providing a visual representation of the product experience throughout its development and launch. Visual records can supplement qualitative data and provide a richer understanding of the user experience. High-quality product photos can showcase the product's features, materials, and aesthetics, creating a visually appealing representation of the product.

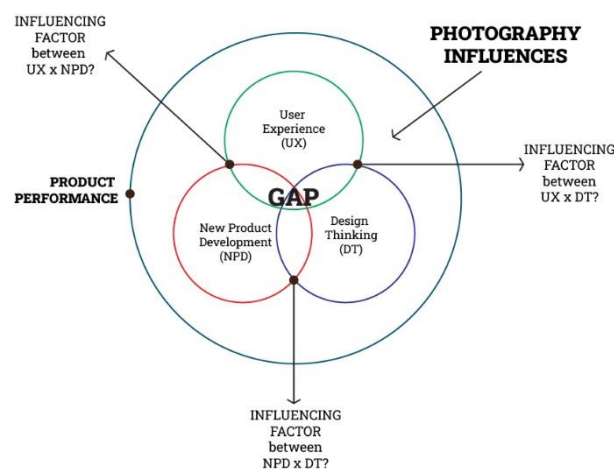


Figure 2: Intersection of Three Circle to Show the Influencing Factors Between Components and Identify the Link and Gap

UX and DT have a mutually beneficial relationship. DT is a problem-solving approach that focuses on understanding users' needs and designing solutions that address those needs effectively. UX, on the other hand, is the result of applying DT principles and methodologies to create a positive and meaningful user experience with a product.

DT begins with empathy, aiming to deeply understand users, their goals and their pain points. This empathetic understanding forms the foundation of UX design. By using DT, designers can gain insights into users' behaviors, motivations and preferences. These insights help inform the design process, ensuring that the final product or solution aligns with users' needs and desires. DT provides a framework for UX designers to explore different ideas, generate multiple solutions, and iterate on designs based on user feedback.

In the context of photography, the relationship between UX and DT is still relevant and significant. DT principles can be applied to photography to create a more engaging and satisfying experience for photographers and viewers alike. To capture photographs of the user interacting with the product's performance, photographers can experiment with various compositions, lighting setups, and camera settings. It can then evaluate the results, seek feedback from others and refine their approach based on the insights gained.

When applied to NPD, DT emphasizes collaboration and interdisciplinary teamwork. It encourages diverse perspectives and expertise to be brought together during the product

development process. This multidisciplinary approach can lead to more holistic and innovative solutions by considering a range of viewpoints, such as engineering and UX. DT emphasizes the importance of prototyping and iteration. Rather than relying solely on theoretical or hypothetical solutions, design thinkers emphasize the creation of tangible prototypes that can be tested and refined based on user feedback. This iterative process allows for continuous improvement and refinement of the product, increasing the chances of creating a successful and desirable solution and iterative approach to NPD.

In essence, DT acts as a bridge between NPD and UX. It guides the development process by fostering a deep understanding of user needs, promoting collaboration and emphasizing iteration. By integrating DT principles, it can create innovative products that resonate with users, resulting in improved user experiences and higher chances of market success.

By attempting to fulfil a gap in assessing product performance through NPD and DT activities, while incorporating influences from photography, it becomes crucial to identify and resolve any issues or shortcomings that may arise with the product with UX. This highlights the significance of product performance photography and underscores the need to formulate an effective problem statement.

2. Photography in Design Thinking Process

Depending on how it is utilised, photography can be incorporated into a variety of different processes within the design thinking process. Design thinking cannot commence without a deeper grasp of the target audience. As a design thinker, you must empathise with the people you are designing for to understand their requirements, thoughts, feelings and motivations to acquire these insights. Kummitha (2019) states that during the initial phase of problem identification, designers may have imprecise and hazy notions, the comprehension of which is crucial. According to this pillar, design thinking is all about comprehending or investigating wicked problems and the user experience that the design thinking process seeks to enhance. Thus, it becomes quite appropriate to study users and their actual living environment.

Susan Sontag (2017) mentions in her book 'On Photography' that photographer Ansel Adams distinguishes between 'taking' and 'making' a photograph. This attitude is readily apparent in the field of product design, where photographs frequently appear to have been taken in random ways rather than purposefully. To facilitate the transition from a 'documentary' to a 'purpose-based' approach to product photography, a form of 'functional analysis' or 'process framing' could be utilised. To determine what is an appropriate and purpose-based photograph to communicate and represent a project, one must consider all aspects of the photograph, including how it is conceived, how it is conveyed and who will receive it.

Photography serves as a valuable tool within the design thinking process. The role of photography in the exploration of product performance is crucial, particularly within the context of design thinking. Photography enables designers to visually capture and communicate the essence of a product's performance, allowing for a deeper understanding of its capabilities and potential user experiences. By incorporating photography into the design thinking approach, designers can leverage its power to inspire innovative solutions, foster empathy with end-users and facilitate collaborative discussions. This continuation emphasizes the importance of photography by highlighting how it enhances the design thinking process. It highlights photography's ability to visually communicate product performance and its potential to stimulate creativity and empathy, which are central aspects of design thinking.

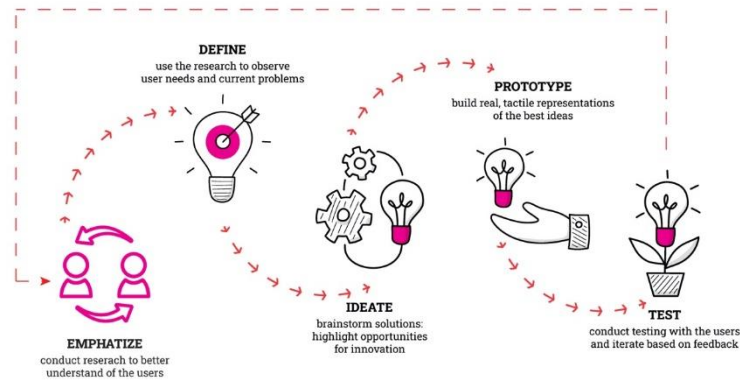


Figure 3: Design Thinking Process Diagram

The conceptual legitimacy of photography is well-established in the social sciences but has been missing from design thinking practices. Photography inferencing promotes understanding in research, photo and video recording as a method of teaching and learning and observation are the most common applications of photography and related journals, with more creative approaches being used. Figure 3 illustrates how Design Thinking is a method of design that uses a human-centric approach to solve design problems.

Here are some examples of how photography can be integrated into the different stages of the design thinking process. During the empathy stage, designers aim to comprehend the needs and perspectives of the people they are designing for. Photography proves useful in documenting user research activities like interviews, observations, and site visits, facilitating a deeper understanding of the users. By capturing photos of individuals in their natural environments, designers gain insights into their behaviors, emotions and needs.

In the define stage, designers consolidate their research findings and define the problem they seek to address. Photography can visually represent the research data, such as creating visual maps of user needs or galleries of user stories. This aids designers in identifying patterns and themes in the data, fostering a shared understanding of the problem they aim to solve. Designers come up with a wide variety of concepts and ideas during the ideation stage to address the specified issue. Inspiration can be found in photography, which helps designers think creatively and come up with new concepts. Designers, for instance, can find potential for innovation by looking at images of existing products, environments, or experiences.

Designers create low-fidelity prototypes throughout the prototyping stage to test and perfect their ideas. Photography helps to document the prototyping process and allows prototypes to be shared with others for feedback. Designers can take photographs of the prototypes and consumers interacting with them to acquire a better idea of how the prototypes are used. During the testing stage, designers gather feedback from users regarding the prototypes and leverage this input to improve their design. Photography plays a role in documenting the testing process and capturing user feedback. Designers can take photos of users using the prototypes, along with their reactions and comments, to gain insights into their needs and preferences.

3. Photography in New Product Development (NPD) Activity

After incorporating photography into the design thinking approach, it becomes relevant to relate it to the New Product Development (NPD) activity. John Sandars (2020) explains that the origins of design thinking models can be traced back to product designers, who sought to

encapsulate the creative and innovative processes they employ when developing new products.

Integrating photography into the design thinking approach enhances the New Product Development (NPD) activity by providing tangible visual evidence of product performance. Through the lens of photography, designers can capture moments that showcase the practicality, functionality and unique features of a new product. These visual representations serve as powerful tools during the NPD process, allowing designers to communicate their ideas effectively, gain stakeholder buy-in and facilitate informed decision-making. By leveraging photography within NPD, designers can bridge the gap between conceptual design and real-world implementation, ensuring that the final product aligns with user expectations and industry standards.

Table 1 shows New Product Development (NPD) activity by providing valuable insights and benefits throughout the process. Photography in the NPD development activity serves as a versatile tool that aids documentation, inspiration, user research, communication and evaluation. Its visual nature enhances various aspects of the design process, ultimately contributing to the creation of innovative, user-centric products investigation through contextual inquiry. Contextual inquiry is one of the many tools that help researchers to understand users, their circumstances and how they might deal with actual products.

Table 1:

New Product Development (NPD) Activities

No	Steps	Activities
1	<i>Documentation and Inspiration</i>	<i>Photography allows designers to document and capture different stages of the NPD process, from initial sketches and prototypes to final product iterations. These visual records serve as a source of inspiration and reference for the design team, enabling them to revisit and build upon previous ideas, iterate designs, and track progress.</i>
2	<i>User Research and Empathy</i>	<i>Photography can be employed as a tool for user research, allowing designers to observe and understand users' behaviors, needs, and preferences. By capturing images of users interacting with products or conducting field observations, designers gain valuable insights that inform the development of user-centered designs. Visual documentation helps in building empathy with users and fosters a deeper understanding of their experiences and pain points.</i>
3	<i>Communication and Collaboration</i>	<i>Photography facilitates effective communication and collaboration among stakeholders involved in the NPD process. Visual representations of product concepts, design iterations, and user feedback help bridge communication gaps, enabling clearer and more concise explanations. Photographs can also be shared with team members, clients, or investors, providing a visual common ground for discussions and decision-making.</i>
4	<i>Evaluation and Testing</i>	<i>Photography assists in evaluating product prototypes and gathering feedback during testing phases. By capturing images of prototypes in action, designers can assess the usability, functionality, and performance of the product. These visual records can be used to identify areas of improvement, track design changes, and compare iterations.</i>

Within the photography contextual enquiry, researcher able to dialogue and frame feedback to summarise the experience. This study's importance highlights the application concept created through a partnership between researchers, user and designer. The researcher picks up knowledge by observing, politely questioning, and striving to comprehend why things are done a specific way. In response, the respondent in this instance explains by carrying out tasks and discussing them as they are completed. When people talk about how they work while they are really doing the work, the transfer of knowledge about work structure occurs more reliably (Vermol, 2018). Research findings are therefore more trustworthy. The experiment's findings broaden the scope of design study.

Analysis of Photography in Problem Understanding

Analyzing photographs in problem understanding within the context of design thinking is a valuable approach for gaining insights, generating ideas and developing innovative solutions. By adopting an empathetic and user-centered perspective, observing details and patterns, identifying core problems, and engaging in iterative refinement, designers can effectively leverage photographs to inform their problem-solving process.

Visual analysis of photographs helps capture the context, emotions and interactions of the people depicted, providing a rich source of inspiration and understanding. By using the photograph as a stimulus for ideation, visualization and communication, designers can collaboratively explore and address user needs, cultural factors and environmental influences. Ultimately, integrating the analysis of photographs into the design thinking framework enhances empathy, creativity and the development of user-centric solutions.

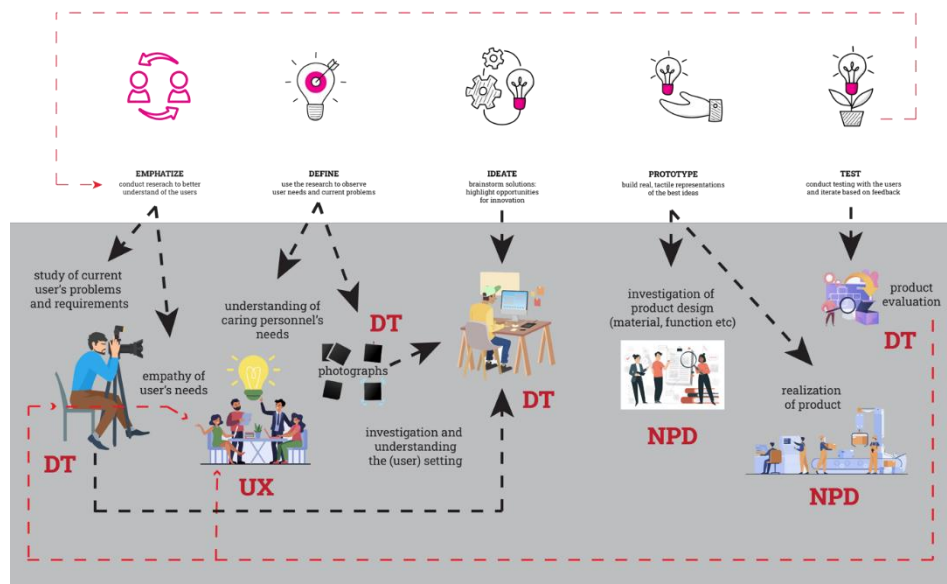


Figure 4: The Exploration of Product Performance Photography in New Product Development (NPD)

Activity: A Design Thinking Approach Diagram

The design and development of new products incorporated product performance photography, particularly when using a design thinking approach. The study explores the ways in which visual depictions of product performance may enhance comprehension of user needs, stimulate creative ideas, and support the development of user-centered designs within the NPD framework.

Figure 4 explains that the research demonstrates how design thinking can be used for new product development through a method the designer can employ when considering the photography influences approach. New product development can be achieved through human-centered research. The development of the products utilizing a deep user research method and direct communication with end users can significantly lower the barriers to product development and maximize the benefits to the end users. Therefore, this study indicates that the design thinking approach may provide an effective method of understanding empathy and discovering solutions most likely to meet the users' needs. Product performance can only be captured through photography because photography can influence the designer to understand the principle of UX, NPD and DT.

Conclusion

Significantly, the designer should have a deeper understanding of how photography can serve as a research tool to effectively work with product development, user experience (UX), and design thinking (DT).

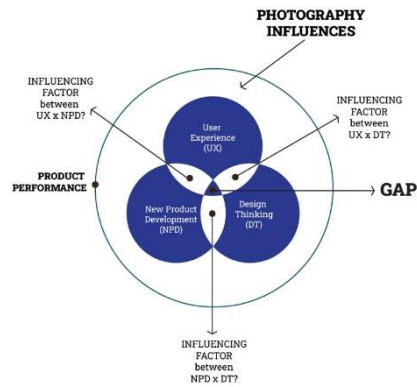


Figure 5: The Triangulations Data Diagram between DT, NPD and UX Principles

Photography has the potential to influence product performance by providing valuable insights and establishing a connection between UX, NPD, and DT. The motivation behind the diagram is to establish relationships between various components, allowing for triangulation of possibilities. Researchers can enhance the validity of their findings by comparing and contrasting data from multiple sources, thereby identifying common patterns or inconsistencies. Figure 5 in the diagram provides a framework that designers can utilize to obtain detailed information regarding how photography influences the informative link between NPD and DT.

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