# NEEDFINDING PRACTICE: ENHANCING STUDENTS' PROBLEM FRAMING SKILLS THROUGH ITERATIVE OBSERVATION FOR BUSINESS INNOVATION

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## ABSTRACT

The ambidextrous balance of combining quantitative and qualitative approach is crucial to achieve business innovation in our ever-changing society. While exploring the early stages of a problem space, profound and iterative observations of human behaviors allow designers to discover unusual insights and users' needs. In this regard, the purpose of this study is to introduce the Needfinding Practice course at KAIST and emphasize the importance of observational research to frame new business opportunities. Main learning goal of this course is to expand the problem finding phase for enhancing students' creativity and divergent thinking abilities. In this study, we have conducted a literature review on needfinding through observation and how the early stage of design thinking process is related to understanding users deeply. By presenting students' field research projects, we highlighted the process of identifying unexpected latent needs to gain qualitative data for future business implications.

**Keywords**: Education, Design methodology, Human behaviour in design, Problem framing, Iterative observation

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## 1 INTRODUCTION

Each discipline has different ways of approaching problems and generating solutions based on the theory of that specific field of study. Depending on the professional background, whether it is in design, engineering, or architecture, people solve problems with methods and tools that are familiar to what they have been trained for during educational stages (Faste, 1981). As Rolf Faste mentioned in his article (1992), engineering schools value their left-brain skills, which is majorly about numbers, formulas, and logical activities. He argues that using both sides of the brain is crucial to leverage "ambidextrous thinking" to merge holistic approach for exploring possible ideas and analytical approach for testing ideas. As the societal challenges are transforming and integrating into a complex system, consumer demands are also rising. This phenomenon makes discovering needs for human-centered innovation and creativity ever so imperative. It is known that creativity implies originality with both novel and practical to bring advantages for the society (Faste, 1972; Grant, 2016). Creativity can be achieved by starting with questioning the existence of the obvious factors, which leads us to look at things differently with a fresh perspective that rearrange old information into new insights (Grant, 2016). Accordingly, the incorporation of design thinking, as a creative act, can help educators to develop a curriculum that is both reflective and intentional; as well as educate learners to apply their knowledge outside of school by challenging the real issues they face while interacting with other people (IDEO, 2013).

In this study, we introduce one of the KAIST (Korea Advanced Institute of Science & Technology) K-School's courses called "Needfinding Practice" where students work in a multidisciplinary team to enhance their observation skills and creative thinking through real-life experience. Students are encouraged to apply their visualization skills in various contexts where they can find the problem to investigate and frame their findings. During field research activities, learners will record facts and opinions about what they have observed and conduct short interviews of the targets to validate their insights and hypotheses. The main goal of this course is to focus on problem-finding space to seek for new business opportunities through the process of observing, capturing insights, generating and evaluating hypotheses, and finding users' latent needs. Two student team projects are summarized as examples of the needfinding process suggested in this course. Each field research project introduced how students conducted observations on human bahaviors and learned from discovering a-ha moments through a series of observational cues. As such, we emphasized the significance of finding users' unmet needs by presenting processes and results of students' projects. This study then provides implications on how these insights and needs are valued to envision new business opportunities.

## 2 LITERATURE BACKGROUND

The concept of making ideas clear and a theory for right reasoning has been around since 1870s when Charles Sanders Peirce (1878) stated that "a few clear ideas are worth more than many confused ones". As creating clear ideas are significant to avoid being obscure, the balance of divergent and convergent thinking becomes crucial in developing distinctive and concrete ideas. These two opposite modes of thinking were first coined by the psychologist Joy Paul Guilford (1950), which are deliberately used during the process of creating new ideas for products and services especially in design and engineering disciplines. Divergent thinking allows exploring creative ideas with many possible solutions while convergent thinking applies logical reasoning to provide viability (Tversky and Chou, 2011). The course introduced in this study focus more on divergent approach as the enrolled students are more familiar to solve problems with convergent approach. This way, students can learn both modes of thinking while tackling a real-world challenge project within a multidisciplinary team.

Another important aspect that is covered in this course is about delivering the importance of discovering people's unmet needs and embracing differences. From wicked problems such as economic, environmental, and political issues around the globe to daily inconveniences, we live in a world where everyday problems became much more complex compared to the past. People are extensively developing their expertise and individual efforts are growing due to unprecedented speed of technological advancement. Still, individuals are exposed to biases that limit our capability to think wisely, making the holistic perspective ever so important (Syed, 2019). Thus, at K-School, students in different disciplines collaborate as a team to observe human behaviors in various social contexts to identify needs that can provide opportunities to solve problems and suggest new business ideas. This



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also connects to integrate design thinking process and methodologies as a way of solving problems by human-centered approach that begins with empathy. Design thinking process allows designers and developers to deeply understand targeted users from the initial stage of problem finding process. Moreover, the importance of needfinding through observation and the value of applying design thinking will be explained in the following sub-chapters.

## 2.1 Needfinding through observation

In the process of finding problems, ethnographical research methods such as, analyzing human behaviors through observational research, works more effectively when seeking for undiscovered insights; instead of heading straight to market research including statistics and quantitative data (Garbuio and Nidthida, 2020). Qualitative information about customers is known to be more descriptive than prescriptive (Patnaik and Becker, 1999). These qualitative data are called "thick data", which is an opposite concept of big data. Thick data pursue small data collection that shows in-depth information about a certain topic (Latzko-toth et al., 2017). Data thickness involves genuine stories that elicit people's emotions and unconventional thoughts, which quantitative data cannot provide. Big data have been at the center stage for decades as people trust vast volume of datasets when it comes to a decision-making process; however, using information at large scale may lose human-centeredness in depth. According to Underhill (1999), creative people, who are open-minded with boundless curiosity, have proven to be competent for precisely documenting and observing human behaviors in the retail industry. Because of these reasons, many organizations across the world have been keen to employ anthropologists as researchers of consumer insights (Underhill, 1999; Patnaik and Becker, 1999). Observers make unusual findings by "noticing things that are not obvious to others", which becomes an insight that is the "discovery of new patterns" (Klein, 2013). Insights are known as consistent flow of data created by multiple observations and accumulated knowledge that takes a long period of time to acquire (Garbuio and Nidthida, 2020). Patnaik and Becker (1999) argued that observation alone cannot determine people's needs. Interviewing and asking people about their observed actions should follow to validate the reasoning behind.

Needfinding process leads to uncovering latent needs of the users to find out how their actions are different from what they say they do. It is an activity that requires empathy with the needer, who is experiencing the need (Faste, 1987). In this course, students' challenge is in finding needs from revealing unknown problem and undefined solution. The goal is to design visionary products that demands the highest level of novelty; therefore, abductive reasoning is necessary in case both problem and solution are undefined with incomplete information (Garbuio and Nidthida, 2020). Abduction, the term coined by Charles Sanders Peirce in his work about the logic of science, is "the process of forming explanatory hypotheses" that depicts the most plausible description of a desired idea developed from a set of observations (Douven, 2021; Eklund et al., 2022). As such, observation, empathy, and needfinding is interrelated with one another to discover users' unusual behavior pattern.

## 2.2 The early stage of design thinking process

The concept of design thinking has been around since 1940s when John E. Arnold collaborated with psychologists, industrial designers, and engineers to establish design division within the department of mechanical engineering at Stanford University (Auernhammer and Roth, 2020). Arnold and his collaborators valued the visual thinking abilities of creative designers and how investigating human needs highly relates to generating a desirable outcome (Arnold and Clancey, 2016). Since then, many advocates contributed on building and spreading design thinking as a process, methods, and tools to achieve innovation through deeply understanding human needs, testing technical feasibility, and verifying business viability (Brown, 2008; Martin, 2009; Kelley and Kelley, 2013).

Recently, the meaning and value of design thinking went beyond a simple practice; it became a paradigm reflecting a holistic set of principles and methodologies (Verganti et al., 2021). For several decades, design thinking process has been incorporated actively in diverse disciplines and organizations across the world. Many companies focus on solution-finding space; however, expanding and strengthening the earlier divergent thinking phase is the key to enhance creativity. Especially before starting a new business, the early stages of design thinking process are essential for preventing ideas to head toward the wrong direction. The problem-finding space, which involves empathy and define stage of design thinking process, is the most interesting and innovative area where designers or creators need to embrace uncertainty and ambiguity (Garbuio and Nidthida, 2020). But instinctively,



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people tend to reject novelty in the face of uncertainty (Grant, 2016). To transform problems into viable business opportunity, the ability to imagine and improvise through human-centered perspective is being valued. However, it does not require a special talent; rather it is natural to most people as they constantly make sense of unfamiliar situations during their daily routine (Eklund et al., 2022). In the empathy stage of design thinking process, designers aim to understand users' wants and needs by thinking, feeling, and doing in their point-of-view (Tuomala and Baxter, 2019). Therefore, this course directs students of various disciplines to learn about collecting qualitative information of targeted users to find the right problem before jumping into generating solutions and answers.

## 3 COURSE STRUCTURE: NEEDFINDING PRACTICE

This chapter will introduce the curriculum of Needfinding Practice. K-School was established in 2016 with the purpose of integrating entrepreneurship in KAIST's specialized engineering curriculum. This course is open to all undergraduate and graduate students of KAIST, who are interested in incubating ideas and creativity to launch start-ups. Sixteen students from industrial design, engineering, and business management joined the course for this semester. The purpose of this course is to expose students to a human centered approach to innovation called design thinking, and subsequently lay the foundation of the different aspects associated to needfinding, which includes empathy, ideation, prototyping and testing. From this course, students will learn to collaborate as they will work in multidisciplinary teams and gain real world experience through on/off campus activities. Later in the chapter, student projects will be presented as case studies of an effective learning process.

Table 1 shows the four phases of needfinding process suggested in this course. The first phase "discover" includes activities which allow students to learn the importance of discovering needs and human centered innovation. Understanding the importance of the power of observation is essential in the initial stage of the process. In the second phase "empathize", students are encouraged to search for insights based on profound observation through field research. They are expected to record and analyze human behaviors in a specific location and context for generating hypotheses based on their observations. Students must evaluate their hypotheses by conducting a short interview of consumers or collecting more qualitative data from public observation. The aim is to seek for an unexpected a-ha moment, which brings up new opportunities uncovering new business areas. The third phase "ideate" allows students to define the needs of consumers and envision possible solutions. The key point is to discover consumers' unmet needs and create a story based on their qualitative findings during observations inferred from the context. The last "execute" phase involves creating a business model and project documentation. The objective is to structuralize a new business model considering the current and future market trend. Throughout these phases, students will learn about various design thinking methodologies, especially regarding the discover and empathize phase, to eventually come up with an innovative business model.

*Table 1. Needfinding process of the course*

| Phase | 1: Discover | 2: Empathize | 3: Ideate | 4: Execute |
|---|---|---|---|---|
| Weekly Activities | - Ice-breaking<br>- Needfinding (the beginning of human-centered innovation)<br>- Power of observation<br>- Visual thinking and visualization | - Observe I: Things and human behavior<br>- Observe II: Findings, hypothesis, aha/eureka moment<br>- Observe and Ask: Validation | - Productize your need findings<br>- Need & Solution Fit<br>- Product & Market Fit | - Business Modeling<br>- Final Presentation<br>- Project Documentation |
| Objective | To understand and learn about the foundation of needfinding process | To find insights about human behaviors in a specific context | To analyze consumers' unmet needs and suggest ideas to fulfill their needs | To build a business model based on the solution generated from the previous phase |



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### 3.1 Learning goal and expected outcomes

The Needfinding Practice course offers combination of lectures, workshops, and projects, which is differentiated with most of the other engineering courses where lectures and exams take up a large portion. Figure 1 presents a framework of the course, which highlights learning activities that cover the early stages of design thinking process. Students go through the four phases of needfindng process introduced in Table 1 within sixteen weeks. These four phases are altered from the double diamond process model (Design Council, 2007) developed by the British Design Council and Stanford d.school's design thinking process (Stanford d.school, 2010).
By mainly involving a problem-finding space and a solution-finding space, students are expected to experience both divergent and convergent thinking during their project activities. However, this course places an emphasis on divergent approach where students should look for diverse options to explore new possible ideas and expand their thinking instead of making rapid and concrete decisions.

Main course objectives are as follows:

- Redefine existing problems from a different perspective through observation
- Diversify the approach through empathic understanding of users and usage contexts
- Continuously generate creative ideas by repeating divergent and convergent thinking (spend plenty of time on the divergent thinking process)
- Conduct continuous search for alternative solutions that meet the needs of targeted users

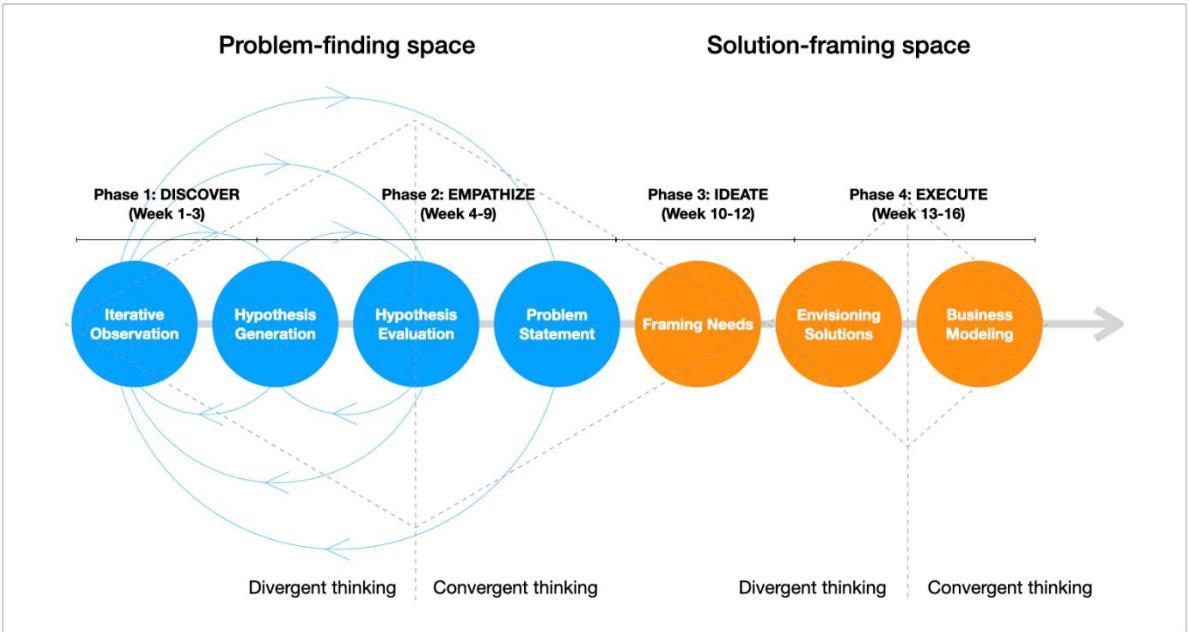


*Figure 1. Framework of the course: emphasis on the problem-finding space*

The course is divided into individual learning sessions and a series of team-based field projects. During individual research, students learn about theoretical and practical use of needfinding and human-centered design, along with the significance of observation and visual thinking to find new opportunities. At the beginning, students are encouraged to practice observing human behaviors from their daily routines and gain qualitative insights. From these activities, students develop a habit of recording and drawing down their insights in detail. Growing a habit of collecting qualitative data is important as the unusual findings and insights are captured during unexpected moments when an observer has gathered an extensive amount of information.

### 3.2 Field projects

Field project started early in the course to dive straight into the real-world experience. First, students individually sought for a research location that evoked their curiosity. Some students began with a preliminary desk research by searching for statistical sales report or a social issue that people are interested in recently. These motivational backgrounds allowed students to select a proper place to



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investigate. After conducting the first round of individual observational research, students each presented the results of their field research. Then, students each chose the study that seemed interesting and teamed up in four groups to continue their advanced observations together.
Initial guidance on the steps and examples of observation activities were provided to students. They were asked to conduct field observations in a new place where they have never visited in the past - spend at least six hours in the same place, but it doesn't have to be six hours straight. This way, they will be able to discover various range of human behaviors and actions occurring throughout the week or at least on different times and days. Write down and draw the findings from human behaviors on a notebook. Capture or record the moment of insight and the process of thinking by photos or videos, notifying that it is important to protect other people's privacy when capturing the scene. While recording the moment of discovery (eureka moment) in detail, think about how and when it happened. And ask what the initial hypothesis was based on what kind of experience. After spending at least six hours of observation, find out the pattern and hypothesis based on insights driven from the thick data they have collected. Keep in mind that hypothesis might change depending on the time frame. Figure out the reason why the findings are meaningful regarding the inference to the best explanation. Throughout the whole observation process, keeping open-minded and deferring judgment during observation activities were emphasized.
Actions to avoid were also listed in the guideline. Students were asked not to focus on quantitative data, instead, be keen to perceive contextual stories behind human behaviors. Be aware of confirmation bias and multi-tasking. Meticulous observation requires concentration and an objective point-of-view to accurately comprehend the situation surrounding the context. Lastly, they were not recommended to observe or ask people they already know.
Before starting observational research, the teams were encouraged to utilize the AEIOU framework, which was originated by Rick E. Robinson, Ilya Prokopoff, John Cain, and Julie Pokorny in 1991 at the innovation consultants Doblin (EthoHub, 2017). The purpose of this framework is to gather data through field research by ethnographic approach considering five aspects: activities, environments, interactions, objects, and users. Each team project was expected to involve findings under the AEIOU framework by using methods such as taking notes, photos and videos, and short interviews or questionnaires. Table 2 shows research questions related to each category.

*Table 2. Questions based on the AEIOU framework*

| Category | Question |
|---|---|
| Activities | Do people have a specific purpose regarding their behaviors?<br>Are they using tools to achieve that purpose? |
| Environments | What is the overall environment like surrounding peoples' activities? |
| Interactions | What emotional, information, behavioral changes are detected between people?<br>Are there any special relationships between people and objects in the environment? |
| Objects | What kind of objects do people interact with?<br>How do they interact with those objects? |
| Users | Who is the user? What is the user doing to achieve a certain purpose?<br>What are other people, who are near the user, doing? |

Two out of four student team projects are summarized in the next sub-chapters. Each project chose different research location and visited the place at least five days for the observational study.

### *3.2.1 Project 1: food court in a department store*

The team visited food courts that are located inside the department stores. In South Korea, as food culture and industry are extremely popular, every department store operate a food court in the building. This way, department stores can create a holistic shopping experience for the customers to enjoy. Observation targets were people who visit department stores to dine-in or buy food and beverages for takeout. The reason why they chose food court in a department store was to observe and analyze consumer behaviors upon the rising demand and increasing sales for foodservice industry in the post-pandemic era. As the industry is recovering, people began to actively dine out recently; thus, different approach to a new marketing strategy is necessary.



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Observational research was mainly conducted during lunch and dinner time. The team analyzed the pattern of human behaviors based on the AEIOU framework. Various observational points are summarized based on the five categories; (1) people order food after they select and occupy their seats first - people prefer four-seater tables, which is more spacious; (2) people tend to select the same menu as their companions for some reason - replica of food displayed in front of the restaurants catch people's attention; (3) people visit the food court after they are done with shopping, a lot of foot traffic occurs during lunch and dinner - people look around for take-out snacks and beverages, which are displayed behind a glass stand. During the observation, the team found out that consumers who visit a department store's food court purchase food with a similar behavior of shopping for other goods by watching, enjoying, and comparing. As such, the team created a needfinding statement that consumers do not go through a simple purchase flow to eat food in a food court. They need precise information and confidence to make satisfying decisions. Hypotheses (H) were generated based on the insights. The team went through a deeper investigation by interviewing and shadowing consumers to validate (V) the hypotheses and to find needs (N). Marketing suggestions (S) were made during the ideation session. Examples are listed below.

H1. The food court entrance has a lot of foot traffic, but a low purchase rate.
V1. Most visitors passed by the first store that was in front of an escalator.
N1. Popular stores or café should be located near an escalator and the entrance of a food court for better and effective traffic flow.
S1. To promote sales of a food court, locate a premium café near the entrance to instill the perception that restaurants in a food court is worth visiting.

H2. Consumers do not check or ask about the price of the food before payment when there is a long waiting line.
V2. Consumers checked the receipt after purchase or asked about the price after payment.
N2. Clear and precise information is needed to easily buy what customers want without confusion.
S2. To promote sales for take-out food, provide a visual information about the price on the display stand.

*Figure 2. Observation of human behaviors in a food court*

In the evaluation report, which students submitted, substantial observations allowed them to figure out current business strategies of various department stores. Qualitative insights led them to question consumers' unmet needs based on their behaviors and considered these aspects to generate ideas for a new business opportunity.

#### *3.2.2 Project 2: bookstore*

The field research took place in a bookstore and the targets were potential customers, who are looking for books about self-improvement. In Korea, self-improvement category is known as one of the bestsellers in a bookstore. The team chose to conduct an observational study in a bookstore to figure out the process leading to purchase and to find out reasons that drive people to select books especially about self-improvement. Unlike fictions, non-fictions, travel literature, or workbooks, people do not seem to have purchase intent for self-improvement category of books before visiting a bookstore. If this statement is true, the team assumed that these customers would behave differently from other visitors who have a specific purchase in mind prior to the visit.
Observation times were held randomly during weekdays and weekends - each session was conducted for at least an hour. The team recorded observations such as duration times, purchase status, whether they were carrying a bag, and what they purchase together with the book. After the research was done,



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they asked several customers for a short interview to validate their findings. Several insights were found regarding customers who visit self-improvement category section; (1) these customers do not search for a specific book prior to the visit; (2) the display and book alignment of this section is more organized than other sections; (3) customers who purchase books related to this category additionally buy stationery. According to the observational research, hypotheses, validations, needs, and solutions were made. Examples are indicated below.

H1. Customers who purchase books about self-improvement visit the bookstore without a purchase intent, but eventually end up buying after briefly reading the book - effective reading time was at least three minutes and less than twenty minutes.
V1. Based on short interviews and observations, people who visited the bookstore to buy something else or did not have any preferences ended up purchasing a book while passing by the self-improvement section.
N1. Visitors of this section need a comfortable place to stay and read for several minutes.
S1. Provide an environment that is suitable for a short reading. (e.g. arrange stools nearby the section without tables or display one sample for each book)

H2. Parents who visit a bookstore with their children purchase a book for themselves as well.
V2. As parents do not have enough time to look around the store, they go straight to the bestseller corner.
N2. They are eager to buy interesting books in a short period of time as they are with their children.
S2. Curate best-selling books near the children's books section for parents to efficiently select and purchase books that they want.


*Figure 3. Observation of human behaviors in a bookstore*

At the end of the project, this team discovered several unexpected findings. For instance, most people who read a certain book on the spot for more than twenty minutes did not purchase the book they were reading. Also, bookstores have their own reasons and policies to arrange various categories; however, at most times, self-improvement and bestsellers sections are near the children's book corner. Based on these insights and needs, the team could gain qualitative consumer data for new business implications.

### 3.3 Reflection: implementing needfinding process for business innovation

Throughout the field research, students learned about the value of unexpected findings by collecting qualitative data from human behaviors. The research flow started from observation, insights, hypothesis generation, hypothesis evaluation, finding needs to envisioning solutions. Unusual insights change how we see things in a whole new way and discovering new patterns let observers to imagine a novel story for the existing market to increase possibilities for business innovation.

## 4 LIMITATIONS AND IMPLICATIONS

Limitation for this study is about the absence of evaluation surveys about the course process and learning outcomes. As the semester is not finalized, the course evaluation survey will be held within a month; however, it would have been helpful to compare how students' mindsets changed before and after the project if a pre-survey was done at the beginning of the course. Another limitation is about introducing a small set of examples regarding students' projects. Yet, both teams went through a deep investigation to search for latent needs that even the users themselves did not realize. Without practicing observational research directly in the field, it would have been difficult for engineering students to find and frame problems with human-centered perspective. Therefore, learning how to



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combine both big data and thick data allows students to have competitive advantage in the field of business.

## 5 CONCLUSION AND FUTURE RESEARCH

Leadership is about finding the right problem at the perfect moment while considering the situation. It is not simply about solving a problem that already exists. Within this context, needfinding is an important phase to develop compelling ideas for future business. Understanding needs becomes a great asset in that it could generate various solutions for different circumstances considering their multidimensional trait.

For the next following years, the course will develop practical guides for effective and substantive field research to introduce advanced observation techniques and cases for identifying users' latent needs. This course will actively send students to face real-world challenges for strengthening their visual and creative thinking abilities. In prospective studies, we are planning to conduct both quantitative and qualitative evaluation regarding how students' mindsets and creative abilities have changed before and after they have practiced needfinding during observational research. Thus, comparing these aspects will lead to better development of the curriculum itself and bring contribution to needfinding, design thinking and creative research fields.


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