

# User-Centered Design for Projector Product Planning

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## Abstract

Following its deployment in enterprises and in educational institutions the projector is now becoming a mainstream commodity. The product development of the projector is required to provide diverse new factors and added improvement values by shifting from the “manufacturer’s viewpoint” to the “user’s viewpoint.” Against this background, NEC Display Solutions has attempted to express the appeal of the developed product in a way that is easy to understand for the user. This has been achieved by introducing user-centered design in the concept and design development processes by using the persona method. This paper introduces how the product concept is clarified and is embedded with the design by following the actual flow of the product development.

## Keywords

concept development, persona, user survey, design development, usage scene, innovation

## 1. Introduction

At NEC Display Solutions, we are developing projector products to meet a wide range of needs, from small mobile projectors to large professional ones for use in movie theaters.

Among them, the data projectors used in enterprise conferences and educational institution classes (hereafter simply referred to as projectors) occupy a share of about 80% of the entire projector market. Under these market conditions competition for new product developments and prices are becoming more severe between the large numbers of participating manufacturers. At the same time, product diversity in terms of the basic performance is becoming more difficult as the market matures. This trend means that it is no longer possible to sustain ascendancy over the competing manufacturers by pursuing performance alone.

Diversity in terms of technical issues is attempted by improving functionality and performance via the addition of energy-saving functions and multimedia compatibility. However, these features have not led to improve customer satisfaction because those have not really been understood or utilized fully by users in the actual usage scenes. Too much effort was poured into the previous planning/development process by adding functions and the requisite approach of identifying how users actually use the projectors and what are their real needs was lacking.

We have introduced user-centered design into projector development in order to deal with the above issues. We thereby attempted to improve the planning/development process with

the aim of differentiating our products. We did this by making them easier to use and understand, based on reviewing the projector function from the user’s viewpoint.

## 2. Product Development Innovations to Support the Planning/Development Process

### 2.1 Issues of the Traditional Planning/Development Process

The traditional planning/development process has tended to adopt the manufacturer’s viewpoint, which approaches the process by first deciding the function and performance.

The projector is a product that began to be deployed rapidly in the early 2000’s, and the initial period of dissemination was the period in which improvements in the basic performance of the new product could become a big appealing point. With the projector, the basic performance means the brightness (lm). Due to restrictions of the component parts, the initial projectors caused inconvenience to users due to insufficient “brightness,” which made it necessary to dim the light before use or to decrease the screen size. In this period, the improvement of the “brightness” was able to improve the convenience of the product and this led directly to the differentiation of the new products.

However, when the brightness reaches or exceeds 3,000 lm, dissatisfaction related to the brightness almost disappears in the general operating environment (with a screen size of 100 inches or less). This has resulted in product differentiation diffi-

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culties by simply improving the basic performance specifications.

On the other hand, we promoted improvements to the functionality and performance by adding energy-saving functions and by enhancing the communication functions via multimedia compatibility. However, these features were not really understood by the users and were therefore not able to be regarded as added values. We identified that one of the factors causing this problem was the difficulty for users to recognize the presence and usage of these functions.

As a result, it has become an issue for us to try to achieve product differentiation by presenting to the users the attractiveness of each function in various usage scenes and by expressing usability. In other words, we needed to innovate by clearly presenting the product concept and by implementing usability to match the concept.

When a user selects a product, he or she considers the balance between “what I want to do” and “what the product can do.” What is important is that “the product can do what I want to do” and an increase in the number of matches between “what I want to do” and “what the product can do” increases the degree of satisfaction and eventually leads to the selection of a specific product. This means that expressing the relationship between “what I want to do” and “what the product can do” in terms of the concept of the user’s viewpoint can clearly transmit the performance of the product to the user and thereby increase the opportunities for selecting optimum products that match the user’s need.

Fig. 1 shows the correlations between the matching of the product concept and need and that of the product performance

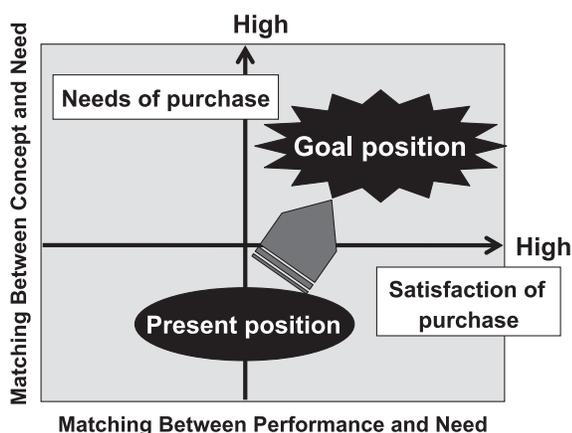


Fig. 1 Matching between concept/performance and needs.

and need. A product can enjoy continual success when the concept is clear and the performance is sufficient and matches the user needs. We set the goal as a shift from the position at the bottom of the graph indicating insufficiency of matching between the concept and need to the ideal position at the upper right of the graph.

### 2.2 Innovation of the Planning/Development Process

Innovation of the planning/development process requires concept clarification from the user’s viewpoint. In place of simply describing the functions, we developed a concept expressing that the effects obtained by the functions satisfy the user needs.

We will explain this in more detail by taking the function for varying the projector brightness as an example.

With the projector, decreasing the brightness leads to a reduction of power consumption and an extension of the lamp’s service life. This allows the projector to meet the user needs of “saving energy” and “extending service life” in cases where dimming of the screen is acceptable. In other words, the brightness variation function can equate with the concept of “environmentally-friendly” for the user, thanks to the keywords of “energy-saving” and “life extension.”

The point here is the shifting of the way of thinking from “the product can vary the brightness” to the user-oriented way of thinking of “the product is value for money thanks to energy saving and long service life.” Expressing the brightness variation function in terms of the added value for the user can communicate the fact that a function matches a need more clearly to the user. The user-centered design process that considers “what I want to do” promotes a shift in the way of thinking. To help this, it is required to clarify what confuses the user and what the user wants.

Those in charge of planning and design do not always know the occasions and ways that the users may use the projectors and what kind of dissatisfactions and satisfactions they feel toward the projectors in detail. Examining these issues becomes an approach to the user-centered design.

Let us examine it by taking the operation of turning a projector ON as an example.

Since the projector lamp does not light up immediately after the power button is pressed, the user becomes insecure if the projector is started up normally. This leads to dissatisfaction of the user who has to push the power button several times or look into the lens.

What the designer usually does to resolve this user dissatis-

faction issue is to shorten the time until the lamp lights up, but what is important for the user is the identification of the power ON status, not the time until the lamp lights up. Reducing the lighting wait time is surely important but from a technical viewpoint, it is difficult to achieve the reduction required intuitively by the user.

Interpreting the cause of dissatisfaction of the user as “the impossibility of identifying whether or not power is ON” instead of “too long time until the lamp lights up” leads to a different method for solving the dissatisfaction issue. In this example, the concept should be shifted from “reduction of lighting waiting time” to “improvement of status indication visibility by increasing the button size” to meet the user need.

To lead such an issue-awareness to a solution of the user’s dissatisfaction and increase the added value of the product, it is necessary to investigate thoroughly into the true reasons underlying the dissatisfaction and inconvenience.

### 3. Practice of User-Centered Design

Innovation of the planning/development process requires as accurate as possible knowledge on the actual usage scenes of the projectors. We therefore reviewed who the users were, what they wanted and what they were dissatisfied with.

#### 3.1 Setting of Simplified Personas

In the present study, we decided to deal with two projector models. One is a standard model that has the highest universality for a wide range of uses in both enterprises and educational institutions. This model is assumed to be used in conference rooms of the small to medium sizes and classrooms accommodating about 40 students. The other model is an installation model that is assumed to be used in a larger space (projection on a large screen). What is important with the standard model is the simplicity of setup because it is sometimes carried and placed on a desktop. What is important with the installation model is the reliability of the installation, as it is often fixed to the ceiling.

The most typical users of projectors are those that give a presentation or class by controlling the projector themselves. In addition, since the projector is often treated as equipment, it is also necessary to consider the persons engaged in its management, maintenance and purchase. More indirectly, the persons who watch the projected picture may also need to be considered.

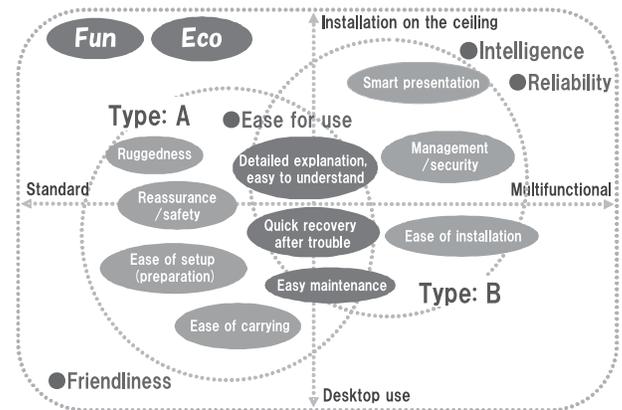


Fig. 2 Concept orientation map.

Consequently, we set the following six types of simplified personas by also considering the differences of the usage scenes between enterprises and educational institutions.

- (1) A corporate employee who uses the equipment in presentations.
- (2) A corporate employee who is in charge of corporate equipment management.
- (3) A person who sells and/or installs the equipment as a job.
- (4) An elementary school teacher who uses the equipment in the classroom.
- (5) An elementary school pupil who attends classes where the equipment is used.
- (6) An IT promotional staff in a school that selects and introduces the equipment.

We brushed up the concept of the newly developed models by creating these six types of simplified personas. Fig. 2 shows the orientations of the concepts. The dot-line circle of Type: A indicates the standard model and its area and the dot-line circle of Type: B indicates the installation model and its area.

#### 3.2 User Survey

We carried out a user survey by researching actual users and by holding interviews to discuss the satisfaction issues, dissatisfaction issues and problems while observing the actual conditions of projector usage. At the same time, we proposed and explained the draft product concepts including function-related ideas and verified their receptivity. The draft product concepts are sketches compiling the function-related ideas proposed in the study of the concept orientations.

Each interview was held by visiting the location in which

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Photo Example of cable connector identifications.

each user uses the projector and by reproducing the normal usage of the user. Careful observation of issues that the users themselves do not notice and of the mis-operations that the users do thinking that they are normal, allowed us to collect the kind of information that cannot be obtained via verbal conversations.

The survey also made possible some discoveries that might serve as a reference for improvements to the user interface. For instance, a school identified each set of main unit terminals and cables by attaching stickers with the same illustrations so that the pupils understood how to connect the projector ( **Photo** ).

We evaluated the proposed product concepts based on the correlation between the strength of the “Do needs” and the “dissatisfaction level.” The strength of “Do needs” refers to the level of desire or “want.” Meanwhile, the “dissatisfaction level” refers to the level of change “that makes possible what used to be impossible” and can also be considered as the “degree of innovation”. The point here is to evaluate the “degree of innovation” from the user’s viewpoint.

### 3.3 Improvement of the Product Concept Based on User Surveys

We brushed up and sorted out the concepts and function-related ideas based on the results of the user survey. The design personnel devised various ideas, but it is hard to assess their values by the persons concerned alone. Whether an idea is an “innovation” that can create added value can be noticed and accepted only by observing the actual usage scenes.

Let us take the sliding cover of the lens as an example. The



Fig. 3 Examples of improvement ideas.

original purpose of the lens cap was to protect the lens. However, it was found that there are many needs for using the lens cap to shield the projected light and that some users block light other than by using the lens cap. We therefore decided to change the previous semi-transparent, detachable lens cap to a sliding-type lens cover that does not transmit light. We additionally finished the size and shape so that the user might intuitively understand that the lens cap can slide to block the light even without reading the instruction manual.

The next example is the control buttons. The projector has 10 or 11 control buttons, which gave the users seeing it for the first time the impression that the control might be difficult. We therefore grouped the buttons to reduce the complex appearance and changed the button sizes according to the frequency of use in order to improve the recognition of frequently used buttons. Simply reducing the number of buttons may sometimes cause dissatisfaction because the control buttons used in the actual usage scenes tend to vary depending on the technical levels of the users. Therefore, we emphasized the possibility of intuitive understanding and designed the buttons by making identification easy by means of grouping and size variations and by introducing common operations to other kinds of equipment.

**Fig. 3** shows an example of ideas for the improvement of the slide cover and control buttons.

### 3.4 Expression of Concept by Design

The standard model is designed based on the catchphrases: “Improve basic performance” further and of “added ease of understanding” and “eco-awareness,” “focus on the functions with strong needs including existing functions” and by targeting the materialization of the concept of “A friendly

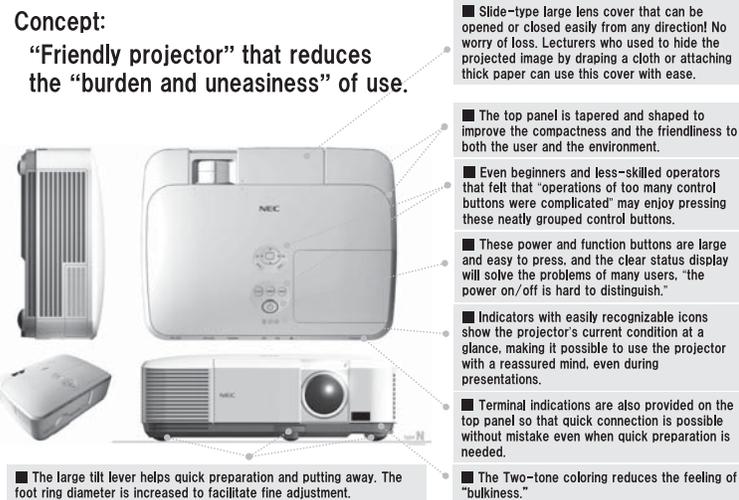


Fig. 4 Example of concept expression with design.

projector” that reduces the “burden and uneasiness” of use. The concrete items were expressed in the forms associated with the product concept by using: a sliding-type large lens cover, grouping the control buttons, enlarging the power button, providing a blue LED lighting indicator, changing the top panel layout by adding terminal indications, providing a large tilting foot lever and giving an image of size and bulk reduction.

Fig. 4 shows the actual draft concept design developed by designing the above items.

#### 4. Approach to the Overseas Markets

The world projector market has been led by the European and North American countries. As a result, about 90% of the projector market of NEC is occupied by regions other than Japan.

We recently conducted a web questionnaire to survey the actual state of use in the USA, which is one of the major projector markets. The questionnaire was returned by 232 persons including 121 teachers and 111 business peoples and we were able to collect answers on their usages, needs and dissatisfaction issues.

The results of the survey made clear a big difference of projector utilization in the field of education between the USA and Japan, which is one of the special characteristics of the regions with advanced projector usage. The projector usage rate

in school classes in the USA was as high as 94% and 58% of American teachers have experience of usage of more than five years.

The top three dissatisfaction issues reported in the overall questionnaire were “time taken for preparation” at 16.4%, “time taken for putting away” at 15.5% and “not easy to carry” at 12.5%, while the top needs for the projector were “ease of use” at 80.2%, “picture quality (good color reproduction)” at 71.1%, “durability” at 64.2%, “quietness” at 63.4% and “audio quality” at 53.9%.

The results of the web questionnaire made it clear that the projectors are used by both enterprises and the educational institutions and their utility value is highly regarded by them, but that many dissatisfaction issues remain to be improved. This allows us to reconfirm that the new product concepts and design orientations have enough receptivity and would also become a tool of product differentiation by solving dissatisfaction in the overseas usage scenes.

#### 5. Conclusion

This new approach was started by thinking about what to do to change the designs of projectors. Our obsession with detail and commitment to the design process allowed us to make fairly accurate judgments on the feedback after launching a product. For example, if there was a comment “the button lay-

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out is easier to understand than before,” it will be a proof of properness of our concept. Even if it were pointed out, “the grouping of the control buttons is illogical,” this would also allow us to consider “why is this layout regarded as being illogical?”

The projectors described in this paper were launched in October 2010 and gained the Gold Award of the Hardware Magazine, a specialist information equipment magazine in Singapore. We appreciate this high evaluation of our efforts by the general public.

### Author's Profile

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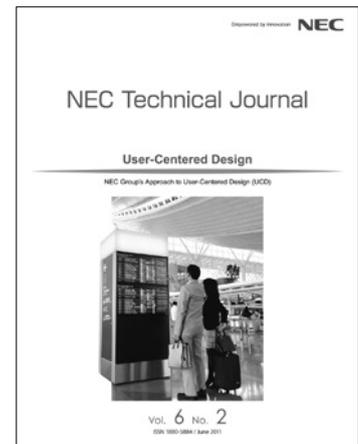
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