A new method of product-service system design: product-based, participatory service design method

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Abstract: With the change of business model, market competition has gradually changed from product competition to service competition, and service design has been paid more and more attention by various industries. The ultimate goal of service design is tantamount to bring users a better experience and maximize the interests of stakeholders. Therefore, this paper will create a service design method based on service dominant logic and more emphasis on user experience. This paper sorts and summarizes the concept, content and characteristics of service design and product service system, and then find out the future development direction of service design and product service system. In this paper, various design methods are analyzed and compared, and one of the best design methods is associated with the product service system to form a new design method. After that, this new design method will be applied to the service design of children's design thinking education as a practice.

1. Introduction

Service is becoming an important commodity in economic activities. Manufacturing companies, for example, are just trying to integrate services into products to create a more complete solution [1]. Service-Dominant logic (S-D logic) describes the transformation from a product-centered market view to a service-oriented model [2]. It holds that the customer is always the co-creator of value. While the enterprise can only make a value proposition, and the customer converts value into value through use [2].

Service design provides a human-centered, holistic, co-creative methodology to develop new services [5,6,7]. In service design, designers take into account the interests and ideas of various stakeholders while optimizing the user experience. Therefore, it is extremely important to understand the suggestions of users and other stakeholders in the design.

Product service system (PSS) is a business model in which an enterprise provides sales services at the same time when selling a product [5]. Instead of providing tangible goods, it is better to provide goods plus services [4]. The basic business benefit of PSS is to enhance the total value of goods by adding service elements. Product service system is a special mode in service design, which also focuses on the user experience [5].

This article will set out the three service design concepts and compare the similarities and differences. According to the final design requirements, a classic design method is selected and changed on the basis of it to form a more specific and more service-oriented product-based new service design method, which is more in line with the service economy.
2. Concept

2.1. Service Design

Service design has been rather introduced as a human-centred and creative approach to service innovation[3]. The definition of service is that service is the application of resources (primarily knowledge and skills) for the benefit of another individual or organization (the beneficiary) [6].

Service design is an emerging field, a method of cross-disciplinary, showing people a new way of thinking - service design thinking [7]. In service design thinking, to provide services, there must be user involvement. Designers need to put users at the center of the service design process, and need to have a real understanding of the user, not just statistical descriptions and empirical analysis. Everyone has creativity. Service design needs to consider different stakeholders. Each group has its own needs and expectations. Therefore, it is a good way to let them participate in the design process and develop co-creation. In addition, service design requires attention to the order and tempo of service delivery. If the tempo of the service is too slow, the customer will get bored. If it is too fast, the customer will be too stressful. However, the service is invisible and short-lived. The designer can materialize the service and extend the service experience by providing the customers with products. This way can effectively improve the customer's loyalty and encourage the customer to recommend it to others. Service design thinking supports collaboration between different disciplines. Therefore, designers need to have an overall awareness [7].

2.2. Product-Service System Design

A product-service system (PSS) is an integrated combination of products and services. This concept embraces a service-led competitive strategy, environmental sustainability, and the basis to differentiate from competitors who simply offer lower priced products [5]. Product service system solutions are a range of products and service components designed to create value for customers.

There are three different types of PSS, which are product-oriented PSS, use-oriented PSS, result-oriented PSS. The fundamental business benefit of a PSS is an improvement in total value for the customer through increasing service elements [5]. The environment also benefits from PSS since a producer becomes more responsible for its products-services through take-back, recycling, and refurbishment-reducing waste through the product’s life [9]. In this way, the company can extend the life of the product, maximize cost- and material- efficiency, and reuse product parts as far as possible after the end of the product's useful life to maximize material utilization [10].

What the customer needs is not a specific product, but a solution of the problem [11]. The main barrier to the adoption of a PSS is the cultural shift, for a consumer to place value on having a need met as opposed to owning a product [8].

2.3. Service-Dominant Logic

Service-dominant logic (S-D logic) describes the transformation from a product-centered market view to a service-oriented model. In S-D logic, it views that goods are appliances for service provision[2], marketing activity is in terms of service-for-service exchange [6,7], customers are seen as the co-creators of value and suppliers as resource integrators. S-D logic facilitates mutual value creation and argues that all businesses are service businesses. Therefore, in S-D logic, it applies to all organizations and economies.

The main content of S-D logic at present are service exchange, resource integration, value cocreation, value determination, and institutions/ecosystems [6]. In S-D logic, the fundamental purpose of the enterprise is to serve itself by serving others. The value can only be actualized in the usage process not in the production phase of the product [13] and it is always uniquely and phenomenon logically determined by the beneficiary [2]. Value is experiential. Each individual (or firm) perceives offerings and integrates them with other resources differently[12]. As a result, each user gets a personalized service. S-D logic advocates a service-ecosystems perspective, which is a relatively self-contained, self-adjusting system of resource-integrating entities that are connected by
shared institutional logic and mutual value creation through service exchange [12]. It needs a sustainable, shared-based service system that can integrate connected resources to achieve a co-creation.

Figure 1. The comparison about SD, PSS, S-D

3. Material and methods
The design requirements of our new method are to meet the needs of users as much as possible, which requires a sufficient understanding of the user's psychology. This paper organizes some user-centric design methods and comparing these design methods in six aspects, and then finds a design method that more closely meets the design requirements. Then based on the service design thinking and S-D logic, the final method is supplemented and modified to obtain a more targeted, user-friendly, sustainable design method for the product service system.

Table 1. Some user-centric design methods.

| classic design methods | method introduction | presenter | new method derived | year | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------------|---------------------|-----------|--------------------|------|---|---|---|---|---|---|
| The PSS approach       | HiCS (Highly Customized Solutions) research project | N. Morelli | A method to design PSS on the basis of customers' active participation [15]. | 2006 | ✓ | ✓ | ✓ |   |   |   |
| Participatory design   | Laura Malinverni, Joan Mora-Guaird, Narcis Pares | K. Kimita et al. | A model to express the changes in customer demands from the perspective of service design [16]. | 2009 | ✓ | ✓ |   |   |   |   |
|                        | Finn Kensing, Jesper Simonsen, and Keld Bødker | Mariesa Nicholas, Penny Hagen, Kitty Rahilly, Nathalie Swainston | The method uses a series of co-design workshops and the role participatory design principles to engage young people in the redesign of the online service ReachOut.com [18]. | 2012 | ✓ | ✓ | ✓ |   |   |   |
|                        | Laura Malinverni, Joan Mora-Guarid, Narcis Pares | Laura Malinverni, Joan Mora-Guarid, Narcis Pares | The multimodal analysis constitutes an effective and coherent method to capture and analyze users' contributions across a wide range of semiotic resources, thus extending the richness of insights that can be derived from a PD workshop and communicated to the rest of the team [17]. | 2016 | ✓ | ✓ | ✓ |   |   |   |

1998
The term co-design refers to the creativity shared by two or more people, which are called collective creativity. It is applied across the whole span of a design process.

Collaborative Customer Co-Design in Online Communities: Challenges the assumption that offering customized products requires an individual (one-to-one) relationship between customer and supplier and uses interactions between customers to reduce mass confusion [20].

Layered Elaboration,” a new technique for co-design with children, allows design teams to generate ideas through an iterative process in which each version leaves prior ideas intact while extending concepts [21].

Cooperative Inquiry: Cooperative Inquiry is a method of design partnering in which adults and children work together. The intense involvement of adults and children together in Cooperative Inquiry sets this method apart from informant design with children [22].

This table evaluates these design methodologies with six indicators, namely: 1: user-centered; 2: commercial; 3: users participate in the design; 4: Consider stakeholders; 5: sustainable; 6: used in the research.

The PSS method mainly emphasizes people-oriented, and the designer needs to pay more attention to the user's experience; the co-design method emphasizes that the user and the designer can design together to understand the user's ideas, so that the designed product can better meet the user's needs; and the participant design method emphasizes the user's participation and voice, and the participation of all stakeholders, which is more consistent with the requirements of SD logic, and according to the service design method, we need to consider all stakeholders, not just users. Therefore, choose a participatory design approach.

4. Methodology

The method is based on a participatory design approach, which is innovated and modified to make the new method applicable to product-oriented product service systems. The new approach needs to take into account the interests and participation of stakeholders, such as external customers, internal employees, manufacturers, and vendors.

In a service process, the service provider (such as a company) is responsible for providing a basic product, which is the carrier of the service, and services, including basic services, target services, and additional services.

There should be several characteristics in the product, which is using environmentally friendly materials, repairable, recyclable, can be mass-produced and valuable. The product cannot be disposable and its life cycle should not be too short. Therefore, the product ought to be repairable and recyclable. The service provider can collectively recycle the products at the end of the use period for reuse. Service should be personalized, but the product should be mass-produced, which not only reduces the cost of production, but also makes it easy for manufacturers to make.

Basic services include repairs, replacements and sale of individual parts of the product, and providing methods of use and value propositions. The target service is the service that the company mainly sells, and the selling price of the product is mainly determined according to the service. The additional service is timely feedback from the service provider on the design suggestions made by the stakeholders, including the reward for adopting the proposal, modification proposals, and the reason for the failure to adopt.

As resource integrator [2], service providers need to summarize the recommendations made by stakeholders on a weekly basis and show the results to stakeholders. It will increase customer loyalty and encourage customers to participate in the service process for a long time [7]. Service providers can ask stakeholders for questions on a regular basis to give some incentives to stimulate stakeholders’ participation.
5. Practice
This practice uses the props in Figure 2 to develop the child's design thinking and intergenerational interactions. The child can tell a story to the old or tell the story of the old through the transformation of the shadow. The basic services provided by service providers are the recycling and replacement of parts, the target service is children's design thinking training, and the additional service is the adoption of recommendations for children's redesign. The service provider's advice is to interact with children and the elderly, reduce the generation gap, and promote intergenerational emotional communication. Value is only achieved when children use this product. The cultivation of children's design thinking lies in the children's use of props to reproduce a story, and the children's redesign of the toy itself.

Figure 2. Product parts schematic

Acknowledgments
The authors thank Mr. Chu for his guidance and error correction and thank the classmates for their help.

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