

A Collaborative Process to Maximize Design Creativity for Pediatric Care

Hyojin Nam, Fiammetta Costa, Giuseppe Andreoni and Maximiliano Romero
Dept. of INDACO Polytechnic University of Milan, Italy

Abstract. Children have different preferences in health care. The family and caregivers also have specialized needs for the children-patients. How to figure out their needs and how to solve the complexity of health care can make a difference in pediatric care and the experiences. The research unit 'Ergonomics and Design' of the Dept. of INDACO in Politecnico di Milano designed product/service systems for pediatric care. To fully explore positive opportunities, the researchers introduced a collaborative but splitted process of 'Concept design' and 'Ergonomic verification'. Through ethnographic studies and multidisciplinary discussions, new concepts were defined under 5 groups which are 'From painful moments to joyful moments', 'Active responsibility for eating', 'Kid-centred space', 'Family-centred space', and 'Efficient & cheerful caregiving'. Among the 19 product proposals which were developed through the whole process, the 'Distributing food' concept and its process are presented as an example in this paper.

Keywords: design innovation, design for health and wellbeing, human-centred design, codesign, action research

1 Introduction

Hospital environments include continuous and dynamic interaction between people and their surroundings that produces physiological and psychological strain on the person (Wilson et al., 2009). Especially, pediatrics needs discreet considerations for various people like children, adolescents and family, and diverse multidisciplinary issues.

The research unit 'Ergonomics and Design' of the Dept. of INDACO in Politecnico di Milano designed product/service systems for pediatric care. For this project, the team researched a pediatric department of a general hospital in Italy, which is specialized for diabetes, obesity and other endocrinologic diseases. The goal of the project was to IMprove Pediatric EXperiences(IMPEX) with a built environment solution including new products.

A preliminary analysis involving all the stakeholders was conducted by the research unit. The products were developed and cross-evaluated in the

'Biodesign' and 'Ergonomics for Design' courses which were provided by the Faculty of Design in Politecnico di Milano. The unusual process from Design to Analysis which was devised by the researchers to maximize Design creativity for making new solutions in health care which is one of the very challenging fields for Design.

2 Background and Key Issues

Children may be the most vulnerable group in health services, who are sometimes misunderstood and misrepresented by adults. According to Piaget, children below 7 years old do not have logical reasoning ability and do not understand cause and effect relationships completely (Piaget, 1967). With the developing and immature cognitive ability, children react to healthcare experiences.

Children's experience in a hospital cannot be broken away from the whole healthcare journey. Hospitalization needs to provide a stage to facilitate the experience of healing (Lee, 2004). How to figure out salient as well as latent needs of children, families and caregivers, and how to solve the complexity of pediatric experience can be more than the improvement of organizational structures and technologies. To understand the pediatric field, the researchers investigated literatures and collected key issues to be considered like below;

2.1 Fear and Pain

In healthcare experiences, there are many things to arouse anxiety and fear in children from injection and human blood to being touched by strangers. For example, type 1 diabetes which needs insulin replacement therapy is one of the most common chronic illnesses in childhood. During hospitalization for the education after the diagnosis or for the regular check-ups, the children everyday face up to invasive procedures like getting a shot, seeing blood come out (Mahat et al., 2004).

2.2 Children's Preferences

Hospitalization can be a traumatic and stressful experience for children. Being alone, bored, scared and sad was known as the main feelings of children in hospitals. Wish to companions and protection was expressed by hospitalized children (Wilson et al., 2009). When the voices and preferences of children are embraced and fed into design solutions, hospital environments can be changed to be fun and familiar

2.3 Family-centred Care

When a child has a chronic illness, the condition has been recognized as having a major impact on the life of the children and families because it requires a higher degree of behavioral regulation than is normal for children of similar age (Wennick et al., 2009). The parents experience parenthood in an ambivalent way. Their responsibility increases owing to the illness, yet there was a need to hand over this responsibility to the affected child. The illness has also influence on the other family members by different degrees. Therefore, the condition becomes a natural element of the families' life. The core value of pediatric care would be to provide the appropriate care with empathy to each family's dynamics.

2.4 Patient Safety

The Institute of Medicine report on errors emphasized that most errors in healthcare are related to systems. The complexity of hospital environments have a direct influence on interruptions and can cause problems in patient safety. In a pediatric ward, there are many sources of interruptions including the environment, other care givers, patients, family members, support ing staffs, and others (Hall et al., 2008). To improve patient safety and working experiences, understanding on the physical environment as well as socio-technical context are required.

3 The Collaboration Process

The whole collaboration is composed of 2 parts. In the first part, the directions of positive changes were defined through ethnographic research and multidisciplinary discussions. In the second part, each product concept was analyzed and developed by undergraduate students of Politecnico di Milano.

The first part before designing products was done by a limited number of researchers because there was limitation to access to the studied hospital by many visitors. However, several meetings with designers,

ergonomists, bioengineers, pediatricians and the people in charge of purchasing and reception at the hospital helped to figure out right problems for right solutions.

The second part for 'Design doing' was divided to 'Concept design' and 'Ergonomic verification'. This was intended to experiment various possibilites at most in a health care setting where many limits and reluctances to a big change exist. Following the iterative process of design-evaluation-modification, the detailed product concepts derived for 'Improved Pediatric EXperiences' were materialized gradually.

3.1 The Collaboration for Conceptualizing Changes

3.1.1 Ethnographic research

Through the ethnographic research which was conducted by the research unit, the environments such as the pediatric ward, the ambulatory space and the emergency room were observed and analyzed. To reveal different aspects of empirical reality, patients and families, doctors and nurses were interviewed on how they work, what they need, what they have around them, how their relationships are, and so on.

For deciding new changes, several assumptions were explored such as 'What if kids were motivated with joy, not fear?', 'What if kids had active responsibility for their health?', 'What if parents were encouraged and strengthened fully?', 'What if parents had active responsibility for kids' health?', 'What if caregivers could use the tools efficiently with pleasure? and 'What if the pediatric ward was a living lab for innovation?'

3.1.2 Defining opportunities

To present the grounds of suggested opportunities during multidisciplinary discussions, the results of the ethnographic research and analysis were synthesized and structurized like key needs and work flows. To facilitate discussions for possible changes, storyboards to illustrate each idea concept were prepared. Another ideas and advices for practical issues were added to the prepared ideas through discussions.



Fig. 1. Examples of the synthesized ethnographic research

New concepts were concluded under 5 groups which are 1) 'From painful moments to joyful

moments', 2) 'Active responsibility for eating', 3) 'Kid-centred space', 4) 'Family-centred space', and 5) 'Efficient & cheerful caregiving'.

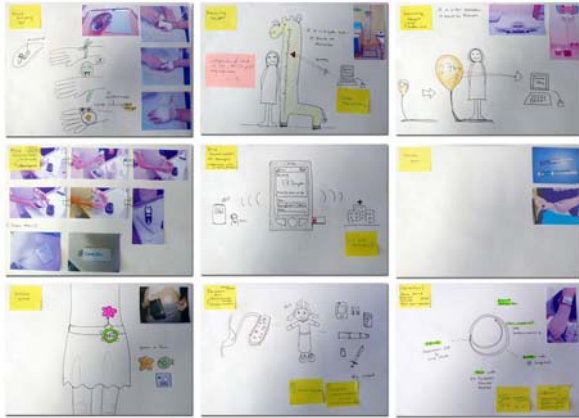


Fig. 2. Examples of the concept storyboards for the discussions

3.2 The Collaboration for Designing Products

Each concept was assigned to a group of students who attended at the 'Biodesign' and 'Ergonomics for Design' courses of the academic year 2009/2010 in Politecnico di Milano. The students were majoring in Industrial Design, Interior Design, Furniture Design, Communication Design and Fashion Design. Each student of both classes chose a concept from the same product pool considering his specialty.

'Biodesign' students were introduced to clinical and design methodology topics according to user-centred approach, and applied the knowledge and techniques into design practice. In the mean time, 'Ergonomics for Design' students who learned ergonomic tools and contents to integrate human factors in different stages of product design took part in research and then analyzed the concepts developed by the 'Biodesign' students.

3.2.1 Concept design

Concept design was an early phase of the design process to explore far-ranging ideas. Two or three students of the 'Biodesign' course collaborated for one product concept as a team. Because of the high ratio of Erasmus exchange students in the course, many teams were composed of multinational students thereby instilling more international visions into concepts.

Students were guided to understand the objectives and context of the proposed concepts. A preparation kit including the previous analysis and research templates were distributed. The templates to help students' progress were prepared considering important issues of target users such as 'Experience process', 'Mind & Needs', 'Relationship' and 'Body boundaries'

of children and families and caregivers, 'Market analysis' as well as 'Product concept/storyboard'.

3.2.2 Ergonomic verification

Subsequently, ergonomic verification was focused on users needs, both children and caregivers. The 'Ergonomics for Design' students looked into the concepts with the ergonomic point of view with the counterpart's works from the 'Biodesign' course. They were encouraged to evaluate each concept design considering users' needs like physical and cognitive characteristics, explicit and tacit needs. As the outcome of the verification process, the 'Ergonomics for Design' students handed in their evaluation and suggestions on the distributed templates. The templates were composed of 6 main ergonomic topics such as 'Anthropometrics', 'Physiology & Biomechanics', 'Perception & HMI', 'Cognition', 'Questionnaire or Focus group', and 'Contextual interview or Ethnographic observation', and 'Design suggestions' regarding concept and storyboard.

3.2.3 Design refinement

The result of Ergonomic verification by the 'Ergonomics for Design' students were delivered to the 'Biodesign' students. Each product was revised and consolidated again based on the evaluation and suggestions from the 'Ergonomics for Design' course. The final results through the iterative process of design-evaluation-refinement were finalized and presented as various solutions to touch different aspects of pediatric care.

4 Results

As the pediatric department which the research team studied was a specialized for diabetes and obesity, the main target users were decided to be the children with those diseases and their families as well as the caregivers. Considering the circumstances in Italy which a child enters an elementary school at 6 years old and starts self-care activities, the target users as patients were down to the children between 6 and 10.

The authors present the 'Distributing food' concept of the 'Active responsibility for eating' group as an example of the 'IMproved Pediatric EXperiences(IMPEX)' project. Including this product, 19 product proposals were developed through the whole process.

4.1 The Background of 'Distributing Food'

Diabetes is a chronic disease requiring a lifelong process. Children with diabetes often have difficulties

in adjusting meals and activities, managing blood glucose and insulin. Meanwhile, childhood obesity can also lead to life-threatening conditions including diabetes, high blood pressure, heart disease, sleep problems, cancer, and other disorders. These health problems significantly contribute to the development of common chronic diseases in later life (Mason et al., 2008).

Therefore, the children need to have the knowledge necessary to make healthy nutritional and physical choices on their own from proper education and training. The period in the pediatric ward can be a good opportunity to learn and get accustomed to healthy behaviours.

In the mean time, meals in hospitals are usually delivered to patients without many choices. Patients with full mobility are sometimes treated as passive receivers on their beds. The research team and students suggested the transformation of the distributing food process and eating experience to give the children active responsibility for their health.

4.2 The Objective

The new ‘Distributing food’ concept was designed to make fully use of eating experience during hospitalization. Combining distributing food and playing can be expected as a specialized training program for the children with diabetes or obesity.

In the research phase, a storyboard to show the possible changes of ‘Distributing food’ was presented at the multidisciplinary discussions. Doctors and administrators of the pediatric ward added ideas and advices.

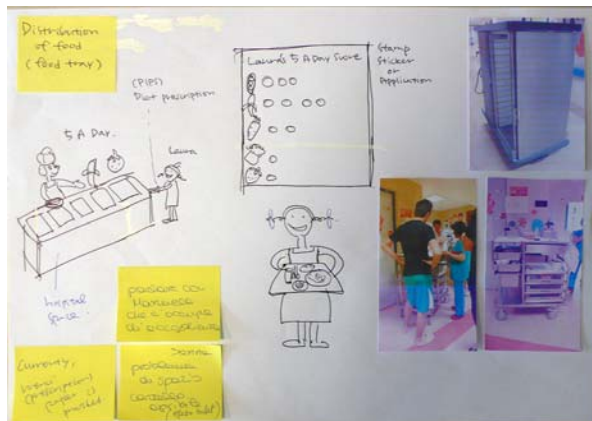


Fig. 3. A storyboard prepared by the researcher to show possible new experiences

For example, the pediatric ward had improved the food carts for children in a way like adding cartoon characters and melodies considering children’s tastes. In addition, they often accepted children from other

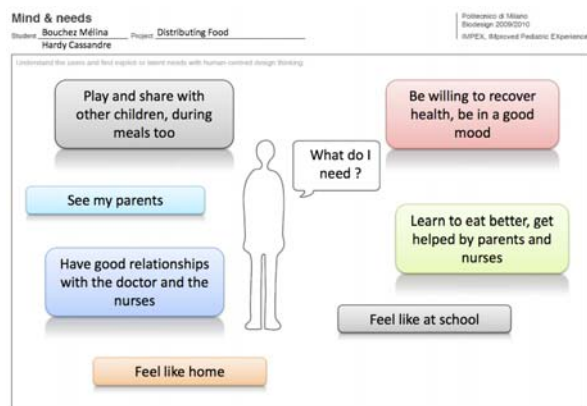
countries and suffered from communication problems between non-Italian speaking patients and Italian caregivers. Though the hospital provided translating services, it did not cover all the needs sufficiently. The pediatric caregivers also expressed their worries to the case of having bigger trolleys without considering the hospital environment. The background information and experts’ opinions were delivered to the students when they were introduced to the project and each product concept

Students were also encouraged to embrace 5 A Day program following the pediatric caregivers’ suggestion. 5 A DAY is a nutritional program to encourage the consumption of at least five portions of fruit and vegetables each day. It is based on the advice from the World Health Organization, which recommends eating a minimum of 400g of fruit and vegetables a day to lower the risk of serious health problems, such as heart disease, stroke, diabetes and obesity (NHS, 2009).

4.3 The Concept Design

The ‘Biodesign’ students started their challenge with looking into the main steps of health care. They tried to identify the people around a child and understood their roles and relationships. They also investigated the issues and needs around people’s body boundaries, and figured out needs. Visiting the pediatric ward and meeting caregivers gave them the opportunity to see the reality and solve unclear issues. The group of ‘Distributing food’ also analyzed the meal delivery solutions in the market, and made the situation and trends out.

From the research, the team concluded to focus on a new food cart supporting self-service. To combine serving food and training children at the same time, the new concept included personal identification and entertainment using 5 A Day program. Ergonomic comfort for both children and caregivers, and children’s preferences were also taken priority.



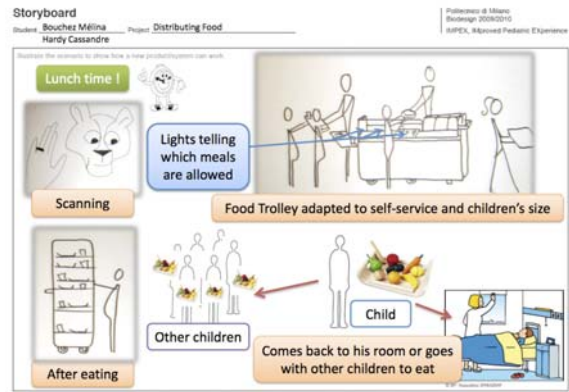
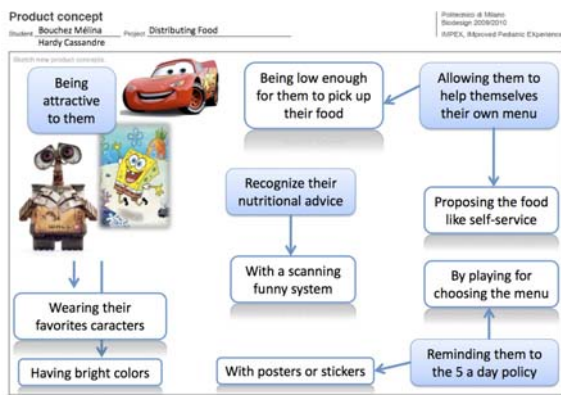


Fig. 5. The suggested 'Distributing food' experience



4.4 The Ergonomic Verification

While the concept design phase was focused on maximum ideation, the ergonomic verification phase was concentrated on realizing ideas as possible as they can.

4.4.1 Physical ergonomics

From anthropometric point of view, analysis was focused on the relationship between body dimensions of the 2 principal user groups, who are children and caregivers. The food cart needed to be verified also at the interaction moments. The students proposed the correct dimensions using 5% feminine and 95% masculine of both target users. The food delivering task was also evaluated by the Ovako Work Analysis System.

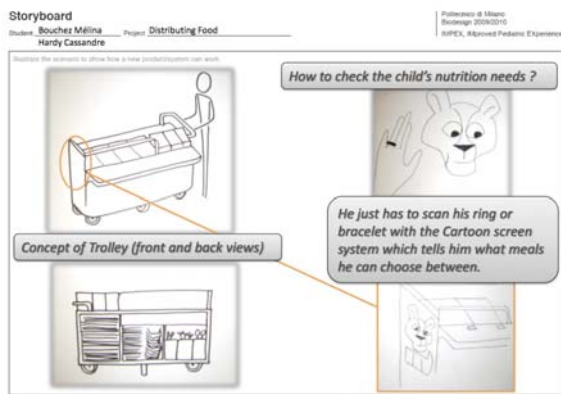


Fig. 4. The Concept design steps and the first proposal

In the proposed scenario, the new trolley allows children to choose their meals freely within the limit of prescription. It provides personal identification and nutritional guides. They also suggested a cartoon interface to encourage healthy and various choices with fun.

Anthropometrics

Show anthropometric dimensions according to users' characteristics.

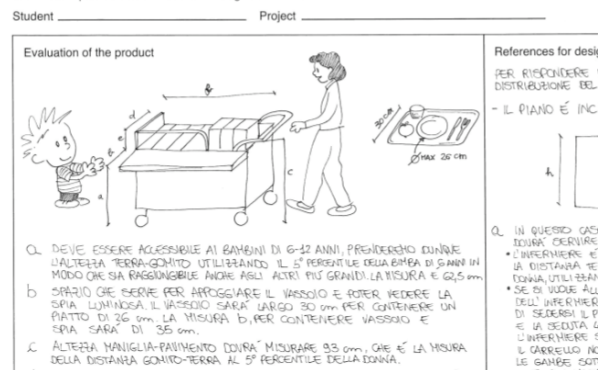


Fig. 6. The compiled 'Anthropometrics' template

4.4.2 Perception and cognition

Regarding the interaction of products and interfaces, several critics and advices were provided to facilitate visibility and affordance.

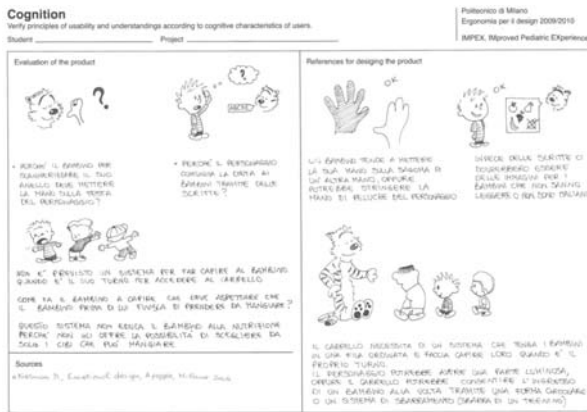


Fig. 7. The compiled 'Cognition' template

4.4.3 User needs

The students had problems to reach real users thereby deciding to elicit user needs from literature studies.

4.4.4 Design suggestions

Finally, the students listed the goals of the product, and revised the whole system. The suggested scenario gave the children a more active role with educational purposes. They also proposed to modify some components of the concept product. For instance, originally, the 'Biodesign' students designed a ring to inform meal times and identify each patient's information. However, the 'Ergonomics for Design' students criticized that a bracelet would be more useful for a hospital setting because of security and comfort issues.

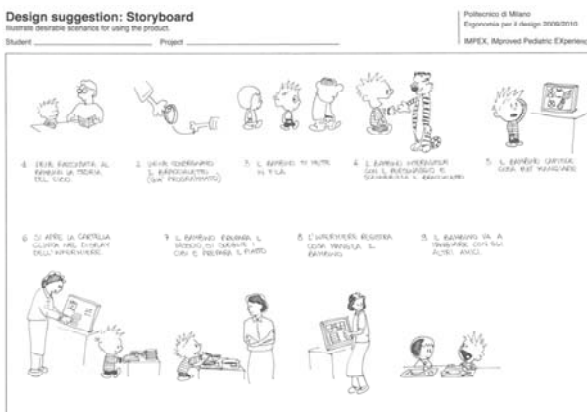


Fig. 8. The compiled 'Design suggestion' template

4.5 The Design Refinement

The 'Biodesign' students revised their concept design based on the evaluation and suggestions from the 'Ergonomics for Design' students.

The final design for distributing food is an expandable trolley at which a child can see possible menus and choose his menu by himself. The students also combined an information system with the trolley. The system provides each child a different nutritional guide with cartoon characters according to prepared menus.

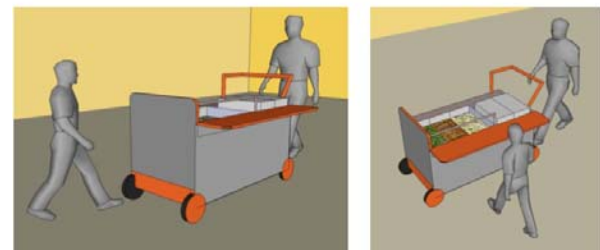
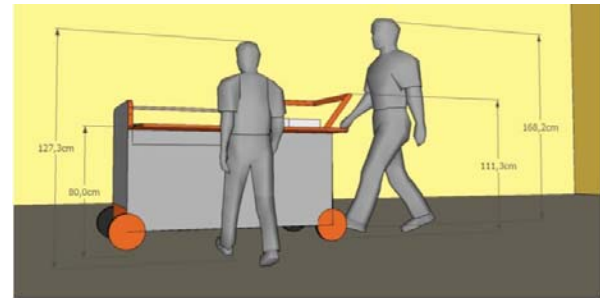


Fig. 9. The final product concept



Fig. 10. The final concept scenario

5 Conclusions

The 19 product proposals including 'Distributing food' were developed through the whole process. The complementarily connected steps of 'Concept design' and 'Ergonomic verification' helped each concept be elaborated for users' needs and practical issues with more concentration.

Using intentionally thematized templates for 'Concept design' and 'Ergonomic evaluation' guided the 2 separate steps to be connected step by step. But

the unusual process inevitably caused lack of information especially in the beginning of each separate step.

Regarding the effectiveness of the designed concepts, the suggested solutions could not have the opportunities to be evaluated in the hospital. Therefore, further research needs to be considered to verify their effectiveness and complement possible errors or variances in a real setting.

Acknowledgement

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