Design Methodology

12

Chapter Outline

- The framework of design methodology
- Original requirements analysis
- Target user analysis
- Stakeholder analysis
- Competitor analysis
- Scenario analysis
- Function list

By the End of This Chapter, You Should Be Able To

- Identify and describe design methodology;
- Understand the framework of design methodology;
- Use design methodology for educational product.

Main Learning Activities

1. Draw a mind map to express the key processes of design methodology.
2. Think about how to design an educational product and the challenges of implementing design methodology in education/game creation.

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12.1 Introduction

Design methodology is a powerful methodology for problem-forming and problem-solving which integrates human, business, and technological factors.

Each designer wishes to work out preferable design; however, the innovative and practical products among the numerous products are just a rarity of the rarities. Designers need a thinking tool to help them master demands, develop divergent thinking, and arrange for product structure. Besides, they also need a design flow to make the design work structuralized, achieve a stable output, and improve work efficiency without omitting elements; they also need a work specification to accumulate and ensure quality and to coordinate between different designers.

In fact, according to the design characteristics of products, different industries have their own methodologies. For example, home furnishing design and graphic design have the universal design methods of the industry, to support for their design process. So does the Internet industry; during the Internet development history of more than 20 years, various companies form their respective design methods suitable for their respective demands.

The design methodology in this chapter summarizes the design experiences of various successful products and is the combination of experiences and skills extracted from multiple design works (including building design, industrial design, software design, and game design).

It is not only a kind of design thinking but also a set of feasible design flow, a complete and overall work specification. The design methodology guides designers to utilize the divergent thinking of the fragmentation and the method of exhaustion, to start from original demands, to conduct in-depth analysis on various design elements such as target user, stakeholders, competitive products, and scenes, and then screen, optimize, and output product functions and prototypes.

As a kind of thinking tool, the design methodology is applied to any design type work, including game designer, software designer, UI designer, management personnel, or even administrative assistant. After the in-depth learning of methodology, they can master user demands, use scene, user pain spots during actual works, to work out better product or service.

12.2 The Framework of Design Methodology

Figure 12.1 depicts the framework of design methodology. Firstly, design methodology based on original requirements, that is, there is a problem that needs to solve. The designers will analyze the target users related to this problem (or original demand), identify the characteristics of the target users from various dimensions, find out the stakeholders (broadly conceived to include learners, teachers, support personnel, and administrators) and their corresponding interests

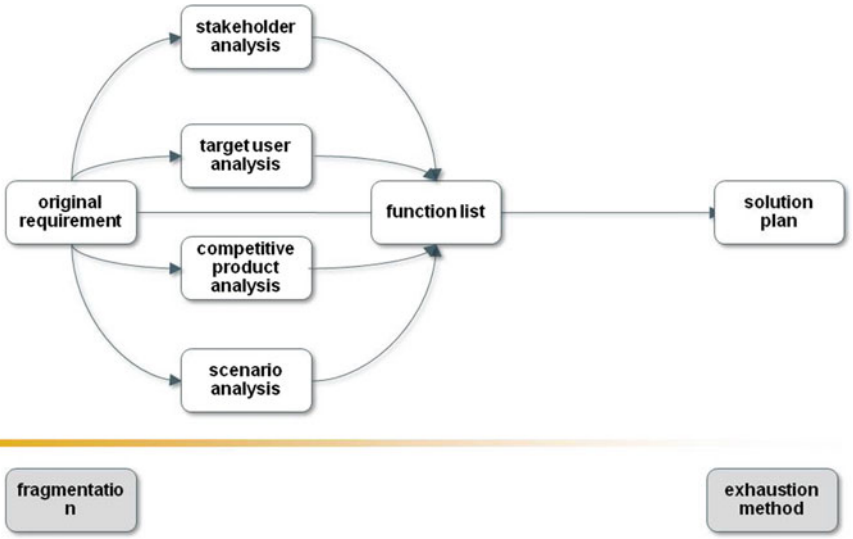

Fig. 12.1 Framework of design methodology

relevant to this problem. After analyzing the target users' demands and interests of the stakeholders, the designers can diversify, select, and improve their designs.

Next, specific to a particular industry and the potential product(s), designers will perform "competitive product analysis" and "scenario analysis" based on the original demand, which includes learning if there is any ready-made solution and what its vulnerabilities are and what can be improved. On the strength of the preliminary design, designers will build users' daily (no solutions) behavior scenarios, mine user pain points, construct the various product application scenarios. In such a concrete process, the design is constantly improved to perfection.

Based on a full analysis of these aspects, designers will integrate a function list, or preliminary solution plan list aiming at the original demand. Finally, based on the "function list" and the original demand, the designers refer to the original demands again, consider the design purpose, and select the most proper and feasible solution to this demand.

No matter what solution plan it is, as a designer, you should never forget to ask yourself: What kind of value does my solution plan (which can also be called the product) create for the user? Or what is the value proposition of this product? The whole process is a design process of focusing on problems, diverging problems, and focusing on problems again. Under the ideal circumstances, this design process is a continuous, repeated, and endless problem-solving process. When thought of in this manner, design research is a kind of specialized formative evaluation effort.

12.3 Original Requirements Analysis

12.3.1 Introduction to Original Requirements Analysis

Original requirements refer to the unprocessed requirements or demands proposed by the originator at the launching stage of the project. It is the truthful description of the originator and product design requirements; it usually does not need modification.

Original requirements are the basis to direct designers to develop the design of products, and the scale to test whether the design complies with requirements. In the product design of designers, there is usually key information of each item that needs to be confirmed with the requirement originator, the proposition of the original requirement concept excellently solves the common problems such as the insufficiency of communication and lack of information in design. Meanwhile, the original requirement marks the product expectation and design boundary and other contents of the original requirement, which is important and necessary for designers.

12.3.2 General Process of Original Requirements Analysis

Original requirements refer to the unprocessed needs or demands that are raised by the demand side in the beginning stage of the project.

- Step 1: Obtain the original needs
- Step 2: Systemize the original needs
- Step 3: Extract the original needs
- Step 4: Confirm the original needs

Original requirements usually are the unprocessed requirements acquired after a series of materials collection, and these materials can be research results or maybe meeting recordings, or the very words proposed directly by the originator. After acquiring the material list from the originator, the designer abstracts typically all unprocessed information one on one from the materials and come up with a copy of complete and structural original requirements and then deliver to the originator for signing and confirmation. After the originator confirms, the original requirements will be used as the direct basis for the subsequent product design.

The original requirement is presented in a structured way, which the designer needs to abstract the information of every structure element from the product design requirement given by the requirement demand side.

Original requirements elements include originator, project name, required material list, original requirements description, target user, design purpose, using

Table 12.1 Elements of original requirements

Demand Originator	
Project name	
Time requirement	
Original requirement description	Main plan and ordering or acquired the original requirement through the user interview
	Acquire the requirement through the user interview, and the product plan must be clear; who the product is meant for, who pays for it, when will it be needed, and so on
	Acquire the requirement through the main plan, the product plan needs to know what the purpose of the main plan is, under what condition does the main plan put forward this requirement, and why this requirement is put forward and so on
Target user	
Design purpose	The designer can abstract the design purpose based on the original requirement
	(That is why the main plan/user puts forward this original requirement)
Using scenario	
Product form	Alternatives: mobile APP, VR APP, connecting to the system, independent Web, independent client end, components, other
Priority adapting platform	Alternatives: 101PAD, mobile phone, PC client end, WEB version, VR equipment, etc.
Required material list	
Signing and confirming by the demand side	
Keyword:	

scenario, time requirement, product form, priority adapting platform, signing and confirming of the originator and keyword, as shown in Table 12.1.

12.3.3 The Websoft Case

The chairman of the Websoft Company held a meeting with its CTO (Chief Technology Officer) to discuss the eye protection function of the student tablet. They determined what modules of functions this product should have, which aspects of design need more attention, and other core contents.

After receiving the meeting recording, the designer analyzed and generated the information structuralized of the meeting recording into a piece of the original requirement table, as shown in Table 12.2.

Table 12.2 Demonstration of original requirements

Demand side	Chairman of the Websoft Company, CTO
Project name	Student tablet-eye protection system
Time requirement	3–5 days
Original requirement description	Collect and analyze the current four eye protection modules (stadium protection, duration protection, eye exercises, ambient light detection), highlight the stadium protection design Design attention points 1. Cultivate the user's habit of eye protection. 2. Rectify the user's wrong activities of eye usage. 3. Help the user to relax the eyes after a long time of eye using (such as guide the user to do eye exercises and look far into the distance). 4. Let the user feel the concern of the product to them. Design Keywords Experience, Personality, Loving, Consistency
Target user	Students using the student tablet
Purposes	1. Protect the eyesight of the user 2. Improve the consciousness of the user for eye protection
Using scenario	Need to consider the ambient light conditions
Required material list	Refer to the completed stadium optimization designing plan (illustrated as the screenshot below)
Signing and confirming by the demand side	
Keywords	Stadium protection, duration protection, eye exercises, ambient light detection

12.4 Target User Analysis

12.4.1 Introduction to Target User Analysis

A target user is the intended audience or readership of publication, advertisement, or other messages. In marketing and advertising, it is a particular group of consumers within the predetermined target market, identified as the targets or recipients for a particular advertisement or message.

In product design, users of different ages, genders, and education may have different ideas on the same product and its operation. Therefore, in the process of product design, we should fully consider the users' various characteristics. Through target users' analysis, we can make clear the target groups of product and their needs. Analysis results for characteristics of users can be used as one of the bases to determine the direction of our product design and priority of requirements.

The function of the target user analysis includes the following:

- Clarify for whom the product is designed.
- Identify users' motive behind the needs.
- Provide a basis for prioritizing the product function design.

12.4.2 The General Process of Target User Analysis

The procedure of the target user analysis includes the following steps:

- Step 1: Analyze the target user according to the attribute tags listed.
- Step 2: Describe the attribute tags that may influence the product design and clarify the specific presentation of such an attribute tag.
- Step 3: Extract the design inspiration from the attribute description.

The attribute of the target user refers to the typical characteristics of the product users. Such attributes usually cover personal information, economy, culture, community, hardware, software, characteristic, etc. Characteristic attribute refers to the values that the target user can generate for the design, which includes psychological characteristic attribute and behavior characteristic attribute.

There are many ways to analyze users, including interviews, live tracking, user-related personnel research, life experience simulation, viewing user analysis report on professional Web sites, reading books for relevant groups written by professionals and so on. One of the most common ways is to view online relevant information.

Table 12.3 User's attribute analysis

Product Name			
Target Users			
Description of Target Users			
Attribute Category	Attribute Specification	Attribute Description	Design Inspiration
Please extract valuable attribute characteristics from the original needs and further analyze them			
Characteristic Attribute			
The attributes in gray are for reference only. Please extract valuable property characteristics from the original needs and further analyze them			
Cultural Attribute			
Community Attribute			

Through these methods, we can understand target users more practically to extract accurately target users' attribute tags and prevent the designer from speculating target user characteristics, to help us to design the product correctly.

After user analysis, users' attribute will be presented clearly in Table 12.3 as follows.

12.4.3 An Example of Target User Analysis

Following the case in 3.3, the next step is the target user analysis for eye protection system, and the product of this analysis is shown in Table 12.4. In this product, target users are junior high and high school students, and we analyze their requirement features in many aspects, such as personalized requirements, preference culture, game awareness, vanity, self-control, study-induced stress, independent learning ability, mind of rivalry, sharing tendencies, rebellious, intensity with eyes, and eyesight protection awareness.

Table 12.4 Target user analysis for eye protection system

Name	101 student tablet-eye protection system
Description of target users	Junior high and high school students for 101 student tablet
Overview of user requirement feature	Personalized requirements: High—custom eye protection mode Preference culture: Personality, pop, animation, youth, star—personalized ringtones, cute reminder mode Game awareness: Loving fun, would invest a lot of time to play fun games—duration reminder Vanity: Want to be successful, need to be encouraged—cumulative eye protection incentive mechanism Self-control: Self-control of pupils is generally poor, their behaviors need to be supervised—sight distance reminder, set the sight distance extreme-near limit and posture reminder Study-induced stress: Big, especially for students in the graduating classes, whose eyes are used intensively every day—tips for eye use Independence learning ability: Primary school students need guidance; high school students do not like to ask the teacher when they encounter problems—eye protection FAQ Mind of rivalry: Have comparative psychology—eye protection system PK among friends Sharing tendencies: Love to share their strengths—share a vision protection report Rebellious: Have a certain degree of rebellious psychology, which is obvious for junior high school students; encourage, moderate reminder way Intensity with eyes: Great, easy to result in pseudomyopia; daily eye reminder; guide to correction of pseudomyopia Eyesight protection awareness: Weak, in addition to myopia caused by heavy learning pressure, there are some students who suffering from myopia because of improper eye position (such as using eyes under poor environment, when lying, at darkness…); use environment reminder, posture reminder

12.5 Stakeholder Analysis

12.5.1 Introduction of Stakeholder Analysis

A stakeholder is a person such as an employee, customer, or citizen who is involved with an organization, society, etc. and therefore has responsibilities towards it and an interest in its success. Kaler (2002) defines stakeholders as those towards whom businesses owe moral duties and obligations beyond those generally owed to the general public. For example, sponsors, clients, users, partners, authority departments, other interested persons, organizations, hardware/software influence, etc.

Analysis of the stakeholders' influence on design will be conducted on the following aspects:

- Clarify the design direction and design boundary.
- Extract the function needs or design inspiration.
- Specify the need priority and serve as a basis for judgment when there is any confliction.

12.5.2 The General Process of Stakeholder Analysis

Stakeholder analysis includes the three steps: to list stakeholders, to analyze the stakeholders, and to extract the function demands.

12.5.2.1 List Stakeholders

To analyze the stakeholders, we need to identify the right stakeholders and ensure that no important stakeholders are omitted. The fragmentation method and the exhaustive method will serve as the two important methods for identifying important stakeholders. We can identify the required stakeholders in the following reference:

- Identifying the stakeholders from the main product scenario or customer process.
- Identifying the stakeholders in the product life circle.
- Identifying stakeholders by searching the keywords.

12.5.2.2 Analyze the Stakeholders

The stakeholders involved in a product are multiple. We can identify and categorize the stakeholders and determine the roles they are playing in a project so that we can catch a structured and logic analysis of the stakeholders.

Table 12.5 Stakeholder analysis worksheet

Classification of stakeholders	Name of stakeholders	Stakeholders' expectation/requirements on the product	Purpose/motivation	Design inspiration

We will classify the stakeholders in several main dimensions such as the contributor, the customer, the user, the authority department, the partner, other parties interested (software and hardware shall also be considered in certain cases).

Then, we will determine the importance of stakeholders through identifying the demands, expectations, contributions, functions of the stakeholders on the program, and prioritize the stakeholders based on their power, influence, attitude, urgency.

Last, we will analyze stakeholders' interest and demands.

12.5.2.3 Extract the Function Demands

Based on the analysis of the stakeholders' project interests, negative impact, expectations/requirements, and objectives/motivation, we can identify the stakeholder's pain points and quick points, get inspirations, and provide the basis for product design.

Design inspiration can be product use scenario, product function, or certain characteristics, etc. At this stage, the content of the design is entirely kept to extract a variety of feasible solutions.

After stakeholder analysis, some elements will be presented clearly in Table 12.5 as follows.

12.5.3 An Example of Stakeholder Analysis

Based on the analysis on the stakeholders' project interests, negative impact, expectations/requirements, and objectives/motivation, we can identify the stakeholder's pain points and quick points, get inspirations, and provide the basis for product design. Table 12.6 is an example of design inspiration from analyzing main stakeholders of the takeout platform.

12.6 Competitor Analysis

12.6.1 Introduction to Competitor Analysis

Competitors are defined as firms offering products or services that are close substitutes, in the sense that they serve the same customer need (Porter, 1980; Kotler, 2000).

Table 12.6 Example of stakeholder analysis

Classification of stakeholders	Name of stakeholders	Stakeholders' expectation/requirements on the product	Purpose/motivation	Design inspiration
Users	Seller	To be able to obtain the order information	Promptness	To be reminded of the order information timely
		To conveniently record and manage the commodity information To timely receive payment and record the billing details To be provided with diversified stores and products To be able to choose the desired products conveniently	Convenience Convenience Diversified Choices Convenience	To record the shop information
				To support display of texts and pictures
				Shop information management
				To create, compile, add/delete, and bulk import information
		To have simple ordering process To have prompt order response and product delivery	Convenience Promptness	To be reminded of payment information
				To be presented with bills and reports
	Buyer	To be provided with accurate store and order information To be able to obtain the order information	Guaranteeing efficiency Promptness	To be able to classify and search the shops
				To be able to classify and search the products
		To conveniently record and manage the commodity information	Convenience	To have smart recommendation
		To timely receive payment and record the billing details To be provided with diversified stores and products	Convenience Diversified choices	To have order process guidance
				To have the existing information be filled in automatically
		To be able to choose the desired products conveniently	Convenience	To have order receiving feedback
	Deliverymen	To have simple ordering process	Convenience	To have complete address information and updated data information

Competitive product analysis, in essence, is a "comparative study" originating from anthropology. It is a qualitative research method that studies user behavior. Firstly, it requires finding out the similar phenomenon or things; secondly, the same phenomena or things are grouped and tabled for comparison; thirdly, conduct further analysis on the comparing results. Its main purpose is to provide references on functionality, usability, key technologies for product design, to help designers to explore the core demands of the target users, and learn how competitive products meet the requirements of the target users.

There are three types of competitors:

- Competitors with identical functions: products that can perform the same function with the target product, and are highly correspondent to the original needs and on the same platform with the target product (Web, desktop, mobile terminal).
- Competitors with similar core functions: products that can perform the same or similar function with the target product, and are highly correspondent to the original needs and on the same platform with the target product (Web, desktop, mobile terminal).
- Competitors with the same-essence function: competitive products that have different realizing channels or forms but can perform the same function with the target product. Such products are usually goods or services with reference values.

12.6.2 General Process of Competitor Analysis

Competitive product analysis includes the following process, as shown in Fig. 12.2:

(1) Competitive products collection: Collect competitive products as many as possible through all available channels;
(2) Competitive products selection: Classify and select the core competitive products worthy of reference from the available competitive products;
(3) Competitive products dismantling and function integration: Dismantle and analyze the core competitive products to understand the motivation behind the design function of competitive products. Identify the excellent design and integrate it into their products.

Fig. 12.2 Process of competitor analysis

12.6.2.1 Competitive Product Collection

Competitive product collection refers to the process to get more referential products through various methods. Analysis of competitive products can contribute to our product design. Under the premise to stick to the core demands of the target user, find more things that can meet the core demands.

Take chat apps as an example. Its core demand is to satisfy the communication demands between people. In addition to QQ, WeChat, Skype, telephone, SMS, e-mail, and even sign language can be used to meet the users' communication demands. Therefore, these products are listed in our competitive products.

Competitive products collecting method is as follows:

(1) Find the right competitive products from app market, professional Web sites, and industrial investigation reports;
(2) Use a search engine, such as Google, Baidu, and Yahoo to find the right competitive products;
(3) User interview: interview the target users to find the right competitive products;
(4) Think if there are any other ways to realize the core functions, such as products of the software, materials, services;
(5) Expand part of the functions: Certain functions can be enlarged to find the right competitive products, such as expanding from buying cinema tickets to buying tickets
(6) Other industries: Analyze how other industries make achievements. For example, consider how the financial industry achieves success when developing a calculator for the education industry.
(7) Others: through fragmentation and operation related method to find competitive products.
(8) Extract keywords based on the key stakeholder analysis and then collect competitive products.

12.6.2.2 Competitive Products Selection

In the actual work, we divide the selected competitive product into three categories based on the product functions, match degree, and realization method. In principle, all competitive products can be classified into one of the three categories:

Competitive products with the same functions: Competitive products are those which can reach the desired targets and share the same platform (Web, desktop, mobile terminal) with our designed software.

Competitive products with similar functions: Competitive products are those which have the same or similar functions and part of their functions conforms to the requirements and shares a different platform (Web, desktop, mobile terminal) with our designed software.

Competitive products which have essentially the same function: referring to competitive products that have different realizing channels or forms but can perform the same function with the target product. Such products are usually goods or services with reference values.

12.6.2.3 Competitive Product Dismantling

Competitive product dismantling is to dismantle competitive products in a fragmentation manner. In simple terms, it is to experience competitive products, get the functions, record the whole process, and make notes for the contents displayed through the dismantling template.

We divide the dismantling into three steps: select competitive products to be dismantled, dismantle competitive products, label dismantling method and add function notes.

12.6.2.4 Competitive Product Function Integration

Competitive product function integration refers to the collection and integration of all the functions of the disassembled competitive product, and the marking of the importance degree of each of them by analysis.

After the disassembly of all competitive products, integrate functions of each competitive product according to "List for Disassembly of Competitive Products." Generally speaking, three levels are reserved for each competitive product: functional modules, the first level of functions and the second level of functions, and the "List for Functional Integration of Competitive Products," formed finally.

After competitor analysis, competitive products selection will be presented in Table 12.7, and competitive products functions disassembly will be presented clearly in Table 12.8.

Table 12.7 Competitive products selection

Summary sheet of the selected competitive products					
Classification of competitive products	Classification description	Competitive product name	Competitive products introduction	Reasons of selection	Design inspiration
Products with the same function					
Products with the same core functions					
Products with functions being the same in nature					

Table 12.8 Competitive products functions disassembly

Competitive products	Functions			Remarks
	Functions of level 1	Functions of level 2	Functions of level 3	

12.6.3 An Example for Competitive Product Analysis

Take the eye use protective system as the example, Appendix 1 is competitive product selection, Appendix 2 is competitive product function disassembly, and Appendix 3 is competitive product functional integration of the eye use protective system.

12.7 Scenario Analysis

12.7.1 Introduction of Scenario Analysis

Scenario refers to the situation which the user may encounter in using or getting in touch with the products, including the operation process and feelings.

Scenario analysis is a process of analyzing possible future events by considering alternative possible outcomes (sometimes called "alternative worlds"). Thus, the scenario analysis, which is a main method of projections, does not try to show one exact picture of the future. Instead, it presents consciously several alternative future developments.

12.7.2 General Process of Scenario Analysis

Generally speaking, the flow of scenario analysis is as follows:

Firstly, it is the listing of elements, and the thinking mode of exhaustion shall be utilized to try to list all the elements related to the product; scenario elements may include time, place, participants, cause, process, tools, application conditions, etc.

Secondly, combine elements one by one according to the listed scenario elements, to describe a general situation of the scenario.

Thirdly, conduct scenario description, i.e., show the behavioral process of users with clear, detailed, and careful flow description. After the process of scenario title and scenario description, we need to mine and summarize pain points and pleasant points of users.

Finally, aiming at the detected user pain points or pleasant points, we shall give corresponding functions or solutions. The whole flow is summarized as five procedures: list of elements, scenario title, scenario description, seeking pain point/pleasant points, and giving solutions, as shown in Fig. 12.3.

After scenario analysis, some elements will be presented clearly in Tables 12.9 and 12.10 as follows:

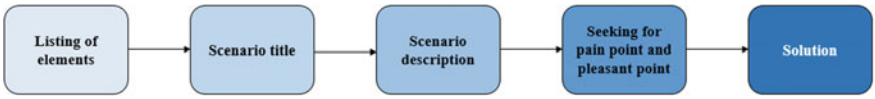

Fig. 12.3 Process of scenario analysis

Table 12.9 Scenario analysis worksheet

Listed elements	
The first-level elements	The second-level elements
Character	
Time	
Place	
Cause	
Process	
Tools	
Condition	
Others	

Table 12.10 Scenario description worksheet

Scenario title	Detailed scenario description	Function extraction

12.7.3 An Example of Scenario Analysis

The scenario analysis for eye use protective system is shown in Appendix 4, and the scenario description and function extraction is shown in Appendix 5.

12.8 Function List

12.8.1 Introduction to the Function List

Function list is the integration of functions that is designed to satisfy certain demands, which also includes the correlation, level of importance, and remarks of the functions. It may be the documents that contain tables, mind maps that can display the relationship between functions.

In "Design Methodology," it is needed to take competitive product function integration result as the framework and blueprint on the basis of considering the core value of the product and acquiring the basic structure of the product, and in combination of the functions acquired from the nodes such as original demand, analysis on stakeholder, analysis on target users, scenario analysis, to form the product function list.

12.8.2 The General Process of Function List

Generally speaking, the output of the function list contains the following procedures:

(1) Reinspect the original demand and sort out the preliminary list
(2) Expand the optional schemes and conduct self-inspection to function list
(3) Make clear the core functions and classify and sort out functions
(4) Conduct screening on function list and rank for function priority
(5) Supplement function description and check on function list

The above procedures can be divided into function integration and function list manufacture:

(1) Function integration is conducted in order to maximize the optional schemes, and it is necessary for the designers to think about the type of functions, the origin of them, and the arrangement structure of them;
(2) Function list manufacture is the procedure for the determination of the final solution, and it is necessary for designers to think of what functions shall be reserved, and what functions are important, and whether the functions are clearly described, etc.

For the final function list, the following procedures could be followed to finish the function list worksheet in Table 12.11.

(1) Step 1: Trim functions. Function classification is to classify all the functions of a product, clarifying the function modules, eliminating or correcting the unnecessary functions, etc.
(2) Step 2: Mark the level of importance. The level of importance for the product functions can be divided into four categories: necessary, suggested, better with, and not suggested. Evaluate the design satisfaction level of the product based on the review of original needs and analyses of stakeholders, competitors, and scenarios. Assume the first version of WhatsApp is to be developed, the necessary functions include registration (bound to phone numbers), dialogue, communication by phones while the suggested functions include portrait, iCloud backup, broadcast, groups, message-receiving confirmation.

Table 12.11 Function list worksheet

Function list				
Module	The first-level functions	The second-level functions	Significance	Remarks

(3) Step 3: Remarks. Enter the reflections on the functions and solutions, including any items deemed to be specified by the designer

12.8.3 An Example of Function List

The function list for eye use protective system is shown in Appendix 6.

12.9 Extended Reading

Approaches to delivering design methodology vary in terminology and phases of execution. The UK design council illustrates a four-stage process: discover, define, develop, and deliver termed the "Double Diamond" (Design Council, 2005), whereas innovation consultancy IDEO (Brown, 2008) proposes the approach incorporating three spaces: inspiration, ideation, and implementation.

12.9.1 Double Diamond

This double diverge-converge pattern was first introduced in 2005 by the British Design Council (Design Council UK, 2005), which called it the double diamond design process model. The Design Council divided the design process into four stages: "discover" and "define"—for the divergence and convergence phases of finding the right problem, and "develop" and "deliver"—for the divergence and convergence phases of finding the right solution.

12.9.2 Design Thinking for Educators (IDEO)

IDEO (pronounced "eye-dee-oh") is an international design and consulting firm founded in Palo Alto, California, in 1991. The company uses the design thinking

methodology to design products, services, environments, and digital experiences. Additionally, the company has become increasingly involved in management consulting and organizational design.

The design process is what puts design thinking into action. It is a structured approach to generating and evolving ideas. It has five phases that help navigate the development from identifying a design challenge to finding and building a solution, which contains discovery, interpretation, ideation, experimentation, and evolution.

It is a deeply human approach that relies on your ability to be intuitive, to interpret what you observe and to develop ideas that are emotionally meaningful to those you are designing for—all skills you are well-versed in as an educator.

Key Points in This Chapter

(1) Design methodology is a powerful methodology for innovation has emerged, which integrates human, business, and technological factors in problem-forming, solving, and design
(2) The framework of design methodology: First, design methodology is based on original requirements or problems; then designers will perform "competitive product analysis," "scenario analysis," "target user analysis," "stakeholder analysis" based on the original demand; after that, designers will integrate a function list; finally, designers will select the most proper and feasible solution to the demand.

Appendices

Appendix 1: Selection of Eye Using Protection System

Summary sheet of the selected competitive products				
Classification of competitive products	Classification description	Competitive product name	Competitive products introduction	Reasons of selection
Products with the same function	1. On the same platform (tablet devices) 2. Target customers of the same category 3. Satisfying the product target of the original demand	Haojixing N787	The product is a fashionable tablet PC for smart learning. It has 7-inch HD touch screen and is made observing the golden ratio. The design fully considers eye protection and has 100% original interaction interface. It has a top teacher counseling, online answering system, large quantities of books and application resources. The Chinese, math, and English courses in it support simultaneous reading. It offers both learning and entertaining services	As competitive products that have the same functions, the product can satisfy the students' needs to protect eye sights. Reference points for our design: light sensor (automatic luminance adjustment), distance sensor (automatic dark screen if the distance is less than 20 CM), fatigue reminding functions (effectively controlling the children's rest and propping out reminding popups for constant one-hour use)
Products with the same core functions	Part of the function complies with the demand: third-party applications for adolescent eyesight protection; 2. Competitive products that are on different platforms with the original demands (tablet devices)	Baby protector APP_V4.3	The product has such featured characteristics as visual protection, positioning, parent private chat room, to prevent the children from overusing telephones, which cause body damage	On-demand special features to be referenced: Eyesight protection; parent private chat room; real-time acquisition of children's actual consecutive phone use time; having automatic reminding functions if the use time exceeds half an hour; reminding eyesight protection after longtime use

(continued)

Appendix 1 (continued)

Summary sheet of the selected competitive products				
Classification of competitive products	Classification description	Competitive product name	Competitive products introduction	Reasons of selection
		Eyesight Protector APP_V4.0	Blue light has the strongest power among the visible lights. Longtime contact with blue light may result in macular area degeneration. This app can reduce blue light intensity and effectively protect the eyesight	On-demand special features to be referenced: automatically filtering blue light; the luminance can be adjusted on the desktop; supporting multiple color temperature selection; the product can be adjusted to the most comfortable luminance by the user
		Eyesight Protection Partner APP_V1.6	Eyesight Protection Partner is an application for eye using reminding and eyesight protection, specially designed for phone users, especially adolescents. It can record the daily accumulated eye using time, single eye using time, reminding of eye using in dark and turbulence. It can also record the using time of every application and provides data analysis. For adolescent users, it can set up parent numbers. The reminding information is sent to the parents' phone by SMS so that the parents and the children can control the eye using time together	On-demand special features to be referenced: Eye using data record; parent remote monitoring; eye using detection in turbulent environment
		Yanmeng APP_V2.0.0.80	It is a mobile software designed for eyesight protection and children protection. It advocates for spending less time on the mobile phones and more time with the family. Parents no longer need to worry about children's eyesight damage resulting from longtime mobile phone using. It provides radiation eyesight protection, shields the harmful hard light, and reduces its longtime damage to retina	On-demand special features to be referenced: Fatigue reminding; activating automatic protection model late at night

(continued)

Appendix 1 (continued)

Summary sheet of the selected competitive products				
Classification of competitive products	Classification description	Competitive product name	Competitive products introduction	Reasons of selection
		Hello, Eye APP_V1.02	This app is specially designed for eye protection. It offers many methods for eye protection and can effectively relieve the pressure after longtime eye using. Referring to Ophthalmology Of Traditional Chinese Medicine, Golden Principles for Ophthalmology, Precious Book of Ophthalmology, based on the specific problems the users are facing, it provides customized advice, recommends the corresponding improving methods in order to relieve the visual fatigue	On-demand special features to be referenced: Reminding at fixed time; providing customized eyesight protection advice; aiding users to find suitable eyesight protection methods; providing different eyesight protection recommendations each day; having flash tips; simple and considerate
		Manual Distance Measuring APP_V2.2.1	This is a powerful measuring tool for distance measurement and fast distance estimation. It is used to measure the distance between any object and the mobile phone with the premise of knowing the length and width of the objective. It can also measure the height, length, and width of an object when distance between the object and the mobile phone is already known	It is downloaded multiple times by users and highly popular; Points to be referenced: This app can estimate the distance of the object faster and provides methods for distance measuring
		EYE TRAINER APP_V1.4.2	It is a practical software used in daily lives. It teaches users with effective eye exercises, relaxes the eyes, and can effectively prevent shortsightedness. Users can exercise with the flashes. It only takes short time for the eyes to relax	It is a highly valued foreign software; Points to be referenced: The 6-minute exercise covers daily training, eye massage, eye yoga, and other eye protection exercises

(continued)

Appendix 1 (continued)

Summary sheet of the selected competitive products				
Classification of competitive products	Classification description	Competitive product name	Competitive products introduction	Reasons of selection
Products with functions being the same in nature	The functions of such products are the same in nature: The products are designed for eyesight protection, shortsightedness protection, or vision correction	Parking sensor	The parking sensor can inform the driver of the surrounding barriers with sound or other visual methods. It eliminates the blind and blurred spots and improves the driving in a safe mode	The product is applied widely and is of great reference value. It can detect the distance and sounds alarms. The nearer the distance is, the smaller the sound gaps are
		Eye exercises	Eye exercises are a kind of hygienic gymnastics program. It can enhance people's sense of eye protection, adjust blood circulation around the eye and the head, and improve eye fatigue. Eye exercise is a carotic massage combining Tuinalogy, meridian and collateral theories, and sports medicine according to research. By massaging these acupoints around the eyes, it expedites eye blood circulation and improves neurotrophy. The curative effect is better with three times a day	It is a traditional eyesight protection method, and the school students are familiar with it. However, it does not mean the students can do the exercises well. The product can help the students to master the correct exercising gesture
		Parents' monitoring	The parents can monitor their children's eye suing behaviors by oral/physical disciplining	It is common in people's daily lives, existing among people with lower self-control, especially primary- and middle-school students
		Distance view pictures	Based on the special perception principle in psychology, stereo photographs with far extending effects are drawn on a two-dimensional space. Eye fatigue resulting from longtime using can be relieved through this method (see the picture on the right side. The constantly changing pictures can constantly change the focal length of the crystalline lens so that the ciliary body responsible for adjusting the crystalline lens can be relaxed in order to protect the eyesight	The eye fatigue and eye pressure can be relieved in simple ways with no execution difficulties

Appendix 2: Competitive Product Function Disassembly of Eye Use Protective System

Competitive products	Functions			Remarks
	The first-level functions	The second-level functions	The third-level functions	
Competitive product A OZING N787	Display position			Environment optical detection for eye protection
			Automatic adjustment luminance	Light sensor: The environment is light, the screen display turns light, and the content on the screen can be clearly seen; when the environment turns dark, the screen turns dark, to protect eyesight
		Eyesight protection switch		When the article or the face is about 20 cm away from the light sensation hold on upper right of the panel, the screen automatically turns off. When the article or the face leaves away, the screen automatically turns on
			Light sensation screen extinguishing delay	10, 0, 60 s
		Fatigue prompt switch		The prompt window pops up during continuous using of 1 h
	Assistant functions			Opening the range sensor function, to effectively supervise the using distance from eye to screen
		Environment distance verification		Open the range sensor
	Timing switch shutdown			Take the reference of if to join in the longtime eye using control plan
		Time		Add multiple time periods
		Frequency		
	Eye protection reminding			Including range of visibility
		Range of visibility		Full-screen display
			Remote screen return	

(continued)

Appendix 2 (continued)

Competitive products	Functions			Remarks
	The first-level functions	The second-level functions	The third-level functions	
Competitive product B: Super follower	Adding members			Add family members, used for monitoring of children eye using problem, and report the child eye using conditions in a real-time way
		Mobile number adding		
		Scanning adding		
		My QR code		
	Continuous service duration			0–90 min Taking minute as the units, 0–90 min
		Use duration statistics		
	Eye state			Preferable, slight fatigue, extreme fatigue
	Eyesight preservation plan			It can provide protective plan for babies
	Immediate protection			
		Rest eye protection wallpaper		Make eyes have a rest
			Return follower	Touch any place to return
	Personal center			
		Head portrait		Picture library and camera
		Nickname		
		Gold coin shopping mall		Conversion of present with coins, and the shopping mall function is not opened
		My task		Earn gold coins and experience by finishing reasonable eye using tasks
		My QR code		

(continued)

Appendix 2 (continued)

Competitive products	Functions			Remarks
	The first-level functions	The second-level functions	The third-level functions	
		Account number		
			Modification	
			Quitting the account	
		Sharing		Sharing to SNS platform
	Family chatting room			
		Sending message		
			Sending character	
			Sending voice	
	Setting			
		Information prompt		
			Voice	
			Shaking	
		Star evaluation		
		Others		
			Quick tour	Install the super follower for babies; scan to add babies/parents; view the position of the other party by positioning
			About	

Appendix 3: Competitive Product Functional Integration of Eye Use Protective System

Module	The first-level functions	The second-level functions	Remarks
Sight distance protection	Eyesight protection switch		When the article or the face is about 20 cm away from the light sensation hole on upper right of the panel, the screen turns off automatically, and it turns on when the article or the face leaves
		Light sensation screen turning off delay setting	10, 30, and 60 s
	Assistant functions		Enable the range sensor function to effectively monitor the using distance between eyes to the screen
		Environment distance verification	Enable the range sensor
	Timely startup and shutdown		Take as the reference, and determine whether to join in the longtime eye using control plan
		Time	It is available to add in multiple durations
		Frequency	
	Eye protection reminding		Including sight distance reminding and fatigue reminding (reminding for longtime eye using)
		Range of visibility	Full-screen display
	Calibration		Conduct calibration if the measurement result detected is not accurate. Recover to the initial measurement direction
		Changing of reference length	
		Changing of reference distance	

(continued)

Appendix 3 (continued)

Module	The first-level functions	The second-level functions	Remarks
Duration protection	Duration of continuous using of device		0–90 min Taking minute as the unit, 0–99 min
		Statistic of using duration	Preferable, slight fatigue, extreme fatigue
	Immediate protection		It can only provide protective plan for babies
		Rest and eye protection wallpaper	Make eyes have a rest
	Eye using state reminding		Judge the eye using state according to continuous using time and give reminding
	Fatigue reminding time down		Describe how many minutes are left to fatigue; with an increase in the fatigue value, the expression figure will change from happy to uncomfortable, as shown in the right-side figure
	Today's opening duration		
		Application using duration	
	Today's using duration		
		Continuous eye-using time	
		Accumulated eye-using duration	
	Fatigue clock		
		Today's screen opening time	It is equivalent to statistics of using time

(continued)

Appendix 3 (continued)

Module	The first-level functions	The second-level functions	Remarks
Environment light monitoring	Setting of desktop shortcut method		Open the desktop using shortcut method and open the eye protection mode in condition of not entering into the application, as shown in the right-side figure
		Customization of eye protection theme color	Users can customize the theme color of the equipment according to eye using environment: opening filtration of harmful light, closing filtration of harmful light, warm green screen theme color, brown dark screen theme and black dark screen theme color
		Brightness adjustment	Select different theme colors and adjust the brightness of corresponding theme colors
	Intelligent filtration		/Opening/closing
		Depth-type filtration dazzling light	
	Dark environment reminding		/Enable/disable the black environment reminding; the system will give alarm when detecting that the surrounding environment is too dark
	Setting accepting child information reminding		It is needed to provide receiving mobile phone
	Jolting environment reminding		Enable/disable
	Setting		
		Children eye using management	/Enable/disable
			Parents can set the mobile phone which receives the children eye using report
		Setting of continuous eye using time reminding	Giving reminding for continuous eye using minutes; 40 min is recommended, with the optional range of 20–60 min
		Daily eye using time reminding	Giving reminding for fixed eye using time on the day; 3 h is recommended, with the optional range of 1–6 h

(continued)

Appendix 3 (continued)

Module	The first-level functions	The second-level functions	Remarks
		Dark environment reminding	The system will give alarm when it detects that the surrounding environment is too dark
		Jolting environment reminding	The system will give the alarm if it detects the jolting environment during certain duration
Eye exercises	Visual fatigue test		Find out the suitable improvement method according to the fatigue test
		Recommended eye protection sports	Recommend a series of fixed time finished eye protection sport tasks
	Eye protection cheats		Everyday pushing of eye protection knowledge
	Introduction to visual fatigue		Popularization of virtual fatigue and protection knowledge
	Wise counsel		Introduction of method reliving eye fatigue; recommend a series of protection schemes according to eye problems: sport, massage of acupoint, eye protection diet
		Sports and exercises	
		Acupoint eye protection skill	
		Dietary therapy recommendation	

Appendix 4: Scenario Title of Eye Use Protective System

Listing of scenario title	
Serial No.	Scenario title
1	Student B cannot help getting closer when using the tablet computer, and Parent C wishes that friend reminding can be given to children when they use tablet computer in an incorrect way
2	When reading books, Student A with shortsightedness is worried about the wrong sight distance
3	Student B is worried about the short sight distance during learning, and he adjusts eyes with distance with textbook with comfortable sight distance
4	[Competitive product scenario] Student B customizes the sight distance with 101 schoolmate party and is not sure if the distance he sets is reasonable
5	[Competitive product scenario] Student B tests on sight distance with 101 schoolmate party, and the screen turns off before the end of the test
6	[Competitive product scenario] Student B wants to recover to default reminding sight distance because he has changed the sight distance for several times when using 101 schoolmate party, but feels uncomfortable
7	Student B revises lessons at home until feeling eyes sore to take some rest
8	On the way to school in the afternoon, Student B opens the mobile phone and checks for new information, but he cannot see clearly under sunshine
9	Student B suddenly wakes up during mid-night and opens the IPAD to see the time
10	[Competitive product scenario] Student B wants to test sight distance with 101 schoolmate party and has no idea about the concept of the sight distance of more than 1700

Appendix 5: Scenario Description of Eye Use Protective System

Serial No.	Detailed scenario description	Function extraction
1	1. Parent C has no time to take care of his child because of busy work 2. He buys a tablet computer for his child Student B, who cannot help getting too close to IPAD when using it 3. Parent C discovers and wishes that friendly reminding can be provided in condition that the child is using the tablet computer in an incorrect way (pain point)	Sight distance reminding

(continued)

Appendix 5 (continued)

Serial No.	Detailed scenario description	Function extraction
2	1. When reading books, the shortsighted Student A starts to pay attention to eye protection to avoid sight drop 2. A learns that the sight distance from eyes to books shall be 1–1.5 chi length and estimates the sight distance 3. But A is worried about his sight distance is not accurate, and he often gets closer after reading for a while, and he has no idea. (pain point)	Sight distance detection; Sight distance reminding
3	1. Student B is worried about the damage to his eyes with short sight distance 2. B sets the comfortable and clear sight distance for himself, and adjusts the distance, and he feels more comfortable than before. (pleasant point)	Customized sight distance
4	1. Student B moves the screen several times when he uses the 101 school party and customizes the sight distance, to adjust to a suitable range 2. But the system does not give the reminding that this is within the scientific range, and B is not sure if the sight distance he sets is reasonable, and he is confused.	
5	1. The shortsighted Student A adjusts the distance to see if he can see clearly when he was measuring sight distance with the schoolmate party 2. However, later, the screen turns down before the end of the test. A is troubled to unlock the screen and make it turn on again. (pain point)	Measurement of sight distance forbidding of screen sleeping
6	1. Student B changes the sight distance for several times when he uses the 101 schoolmate party, and wants to find out the sight distance suitable for him 2. But B cannot find out the suitable sight distance after several times of modification, and he wants to recover to the default reminding sight distance 3. But the system does not provide the option of recovering to the default value; B is confused and has no idea about the ideal sight distance. (pain point)	Recover to default reminding sight distance

(continued)

Appendix 5 (continued)

Serial No.	Detailed scenario description	Function extraction
7	1. Student B revises lessons at night at home and he feels eyes sore later, and a lot of time has passed 3. Therefore, B has to stop and have some rest. He thinks that it is necessary to have somebody remind of him about the reading time. (pain point)	Duration reminding
8	1. Student B goes to school in the afternoon, and there is a reminding of a new message from his mobile phone in the pocket, and B takes out the mobile phone to check 2. It is a sunny day, and B finds that the sunshine is too dazzling, and he can see nothing. Therefore, he still looks at the screen and finds his eyes sore (pain point) 3. B is helpless and has to run to the place without direct sunshine and sees clearly	Environment light detection: high light protection
9	1. Student B wakes up suddenly at midnight, and it is still dark outside. B wants to see the time, and opens the IPAD to see the time 2. When the screen turns on, B cannot open his eyes because of the strong light (pain point)	Environment light detection: low light protection
10	1. Student B measures the sight distance with the 101 schoolmate party, and the system gives the sight distance of more than 1700 for reference 2. But B, who has poor mathematics scores, cannot understand the concept of the sight distance of more than 1700. He is at a loss	30–40CM Sight distance: materialized concept of length (e.g., the distance of a 30–40-cm ruler; keeping a fist distance between the upper body and the desk)

Appendix 6: Function List of Eye Use Protective System (Upper Part)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
Sight distance protection			Must have	Supervise the distance between eyes and screen, to avoid over close to the screen
	Distance alarm		Must have	With close distance, the system pops up reminding; individualized reminding bells, and cute biology reminding method
		Reasonable distance automatic hiding	Must have	After the user adjusts to a suitable range in pop up state, the system automatically hides the alarm box. At the same time, it gives the reminding that "It is the suitable distance, and please keep it."
		No more reminding	Suggest to have	After three times of reminding on each day, it is allowed for users to choose "no more reminding today"
	Sight distance protection setting		Suggest to have	
		Sight distance protection switch	Suggest to have	It is available to enable/disable the sight distance protection function
		Delay reminding setting	Better to have	The lasting time for giving alarm; 1–60 s optional
		Reminding frequency setting	Better to have	For example, it is available to set repeated reminding within 1 min of (1, 2, undefined) times
		Reminding method setting	Better to have	The indicator light blinks, with sound of elfin reminding
		Protection distance setting	Suggest to have	The distance between the eyes of the user and the screen is reflected on the screen, which is taken as reference for users, including recommended distance and customized distance setting. 1. According to the data, it is better to keep at least 30 cm from eyes to screen. [It is pointed by "Children Eyes and Sight Protective Technical Standard" that the distance between eyes and various electric product screen is generally 5–7 times of the diagonal of the screen area (it is suggested for users to keep far distance when using full-screen functions such as video courseware), and the screen surface shall be slightly lower than the height of eyes.][Sight distance: Add concrete concept descriptive distance (for the distance like a rule of 30–40 cm, keeping a fist distance between the upper body and the table surface, etc.)] 2. Customized reminding sight distance includes the following: Over close distance limitation (the distance set by the user is much too close, belonging to invalid setting); It is suggested to adjust the range and conduct sight distance detection (it is available to quit from the detection process), history sight distance (it is available to choose to directly apply the past sight distance)

(continued)

Appendix 6 (continued)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
			Suggest to have	The reminding sight distance is customized by the user
			Suggest to have	The too close set distance by user belongs to invalid setting (the specific value is to be determined)
			Better to have	Provide a reasonable sight distance range, for example 30–40 cm, and users can adjust the sight distance according to the reference value (the sight distance is embodied with the unit of cm)
			Suggest to have	Test on the vertical distance between pad and eyes
			Suggest to have	Save the detected sight distance and apply as the customized sight distance
			Suggest to have	
		Forbid screen sleeping	Suggest to have	Keep the screen on during sight distance detection
			Better to have	It is available to apply the sight distance used before
			Better to have	Delete the not-needed sight distance one by one
Duration protection			Must have	Supervise the continuous using time of PAD by users, to avoid ignoring of rest because of continuous use
	Duration reminding		Must have	The reminding pops up after continuous application of a period of time (it reminds users standing up and looking far to relax eyes after long use of eyes). The time of current version is set as 1 h
		Have a rest	Suggest to have	Turn off the screen immediately, clear the continuous using time, and restart timing
		Ignore	Suggest to have	Close the duration reminding function, clear the continuous using time, and restart timing
		Eye exercises	Better to have	Enter into the eye exercises flow, and please refer to “eye exercises” module for details
		Remind later	Better to have	Reminding later function just like the alarm clock
	Duration protection setting		Suggest to have	This version does not provide setting options for users, and the following contents are scattering results (it is needed to consider later on if the option is provided for users)
		Duration protection switch	Suggest to have	It is available to open/close the duration protection function
		Duration interval setting	Suggest to have	It is 1 h as default, which can be customized: for example, the options of 15 min, 30 min, 45 min, 1 h, and 2 h. In principle, it shall not be for too long, or it will lose the significance
		Effective screen turning off time setting	Better to have	The screen automatically turns on after it is off, which is 5 min as default and can be customized: for example, the options of 1 min, 2 min, 3 min, 4 min, 5 min, and 10 min, not too short in principle
		Next reminding interval time setting	Better to have	After the end of the last rest time, it gives reminding, 15 min as default, which can be customized: for example, the options of 5 min, 10 min, 15 min and 30 min. In principle, the next reminding cannot exceed the normal interval

(continued)

Appendix 6 (continued)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
		Reminding method setting	Better to have	Individualized selection of reminding method: mute, bells (the rings are optional), shaking
		Strengthening alarm level for ignored alarm	Better to have	After the opening of this function, it can strengthen the alarming level after multiple times of reminding (the times for ignoring is set by users), in ways of music or change of marked words, or limitation on further use on users
Eye relief exercises			Suggest to have	
	Overlooking picture		Suggest to have	Show the overlooking picture for users and change patterns to change the focal length of the crystalline lens, to adjust their ciliary body, to make them relaxed, to protect sight
	Simple eye exercises		Suggest to have	A series of short-time eye protection exercises, for example, conversion of looking far and nearby, conversion of black and white, eyeball rotation motion, etc.
		Automatic play of eye exercise course	Suggest to have	
		Pause/continue	Better to have	
		Quit/restart	Better to have	
		Select other exercises	Better to have	Do eye exercises regardless the procedures
		Matter needing attention for eye exercises	Suggest to have	Operating instruction for matters needing attention and eye exercises, including effective eye protection by daily eye exercises, doing it at least each 1.5 h, and doing it after washing hands
		Eye exercises reminding	Better to have	Set two different alarm clock reminding, daily reminding since the setting day as default
	Eye exercises		Suggest to have	Guide the users to practice eye exercises to protect the eyes, (currently competitive products have no eye exercises function, the summary of the function module according to eye exercises designing case)
		Guide to eye exercises	Suggest to have	Show action essentials in the form of manuscripts
		Follow the eye exercises	Suggest to have	Extinguish screen and play the music; the user can do eye exercises with the music. Click the play button on the boot page to start. After playing, on screen at the off-screen state, and automatically pause the music player, and can click the play button to continue

(continued)

Appendix 6 (continued)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
		Eye exercises settings	Better to have	The current version does not provide users with setting options and can provide options such as automatic off-screen switch, automatic on-screen switch, automatic exit switch (need to reconsider whether to provide the user setting options)
	Point eye care tips		Suggest to have	Soothing dry itch, sore acupuncture points, such as the Sibai points, Zanzhu points, Sizhu points, Qingming points, etc.
	Eye care tips		Better to have	
		Recommended eye care diet	Better to have	
		Guide to vision correction	Better to have	Guidance for patients with pseudomyopia and myopia
		Eye disease guide	Better to have	Countermeasures of prevention and alleviation of glaucoma, cataract, and other eye diseases
Ambient light protecting			Must have	Monitor ambient light, automatically match the most suitable equipment light for users to read: brightness, contrast, eye care
	Automatic brightness control		Must have	Automatically optimize brightness based on ambient light conditions, such as to improve brightness under the sunlight and to reduce brightness in dark night
	Manual brightness control		Must have	
		Rationality recommendations	Suggest to have	According to the current ambient light conditions, it is recommended that the user can adjust the range and remind if out the range
	Ambient light protecting setting		Suggest to have	The current version can only choose to automatically adjust the brightness, the other options for the divergence results (need to reconsider whether to provide the user setting options)
		Mode selection	Suggest to have	Choose to adjust the brightness automatically; manually adjust the brightness
		Automatically filter out blue light switch	Better to have	Automatically filter out LED blue light to help relieve retinal damage
		Automatic warm color switch	Better to have	Adjust automatically under the dark environment
		Rationality switch	Better to have	The user can select the system to never provide suggestions

(continued)

Appendix 6 (continued)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
		Refresh rate	Better to have	Selectable 60 Hz, 75 Hz etc.
		Select the eye color theme	Better to have	Users can define the overall environment of the device according to the needs of the eye environment: warm green screen theme color, brown dark screen theme color, black night screen theme color
Other eye care			Better to have	
	Bumpy environmental protection		Better to have	Remind users to pay attention to the eye in the bumpy environment
	Sitting protection		Suggest to have	Monitor the user's sitting position, to prevent lying with the eye, not correct sitting with the eye, to remind the user attention
Eye supervision			Better to have	Encourage users to pay attention to the eye care through the supervision; add members through the {my supervisory team} function: parents and friends
	Parents supervision		Better to have	Only visible to parent account
		Report unreasonable acts in real time	Better to have	Real-time reporting of students with some irrational eye behavior, parents can remotely control student PAD some operations, such as forced extinguishing
		Behavioral daily	Better to have	Daily unreasonable eye behavior report
		Children 's Daily Eye Report	Better to have	The use of time statistics, the use of equipment frequency, the most frequently used software ranking
		Parents supervision setting	Not Adopted	Parents can use this function; parents need to set a password. Parents through the account number or the phone can receive by the user to send the eye report and error with the eye prompt message
	Friends supervision		Better to have	Users take the initiative to form a monitoring group with other students, mutual supervision, broadly similar ideas with the parents, permission to mutual consent
Eye care test			Better to have	Title: Check the symptoms of individual eye problems, such as "time of face the screen every day, read posture, often stay up all night, often knead eye …" the system measured to find the appropriate improvement
	Visual fatigue test		Better to have	
		Report view	Better to have	
		Retest	Better to have	

(continued)

Appendix 6 (continued)

Module	The first-level functions	The second-level functions	Significance	Functional explanation and remarks
		Share the test report	Better to have	Share Microblog, WeChat, circle of friends, space and other SNS platform
		Eye care task	Better to have	According to individual test results, recommended eye care tasks: exercise, massage, diet
	Visual degree test		Better to have	Straighten the arm (with the screen from 70 to 80 cm), according to the direction of the screen E slide the screen with your fingers to complete a test, left and right eyes were tested
		Report view	Better to have	
		Retest	Better to have	
		Share the test report	Better to have	Share Microblog, WeChat, circle of friends, space and other SNS platform
	Color blindness test		Better to have	Resolve the color picture of the test and select the correct answer
		Report view	Better to have	
		Retest	Better to have	
		Share the test report	Better to have	Share Microblog, WeChat, circle of friends, space and other SNS platform
My document			Not Adopted	
	My eye care task		Not Adopted	
		Fun eye care answer	Not Adopted	Such as cold knowledge, knowledge of science, the answer may be awarded to enhance the level of reward
		Fun eye movement	Not Adopted	Such as eye movement games, acupressure massage
		Eye habits develop record	Not Adopted	According to the 21-day effect, it help users develop eye habits timetable/trend; with the achievements to encourage users to some good behavior and habits; it can reflect the number of complete eye exercises to maintain a reasonable line of sight cumulative time, etc., you can share the achievements to the SNS platform
	My supervisory team		Not Adopted	Add the supervision members: parents, classmates, etc..; help to achieve{eye monitoring} function
		Add a member	Not Adopted	You can add parents, students phone or two-dimensional code, mutual supervision through reminders and reports, etc.
		My members management	Not Adopted	Role of parents: parents can only control the children; role of students friends: can form mechanism of mutual supervision and send reports to each other

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