

# Research on the design of parent-child worksheet in the museum context

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**Abstract:** In the era of knowledge economy, the concept of lifelong learning has drawn people's attention gradually. Museum learning, one of the main forms of informal learning, has attracted visitors with its knowledge, entertainment and other characteristics. Therefore, the promotion of learning effect and learning experience of museum learning has also become a research focus. This study focuses on how to improve the learning effect of parent-child groups in museum. More specifically, it intends to promote parent-child interaction through design of parent-child worksheet, consequently help visitors understand the exhibits and improve the learning effects in museum. The paper consists of three aspects: 1. Design the questionnaire for parent-child museum learning, investigate the museum learning expectations, visiting methods, learning experience and expectation of worksheet of the family organizations in the museum, which could provide base for the following design of model of parent-child worksheets. 2. Design parent-child worksheet model. At this stage, this study investigates other researchers' design principles and strategies and designs a model of parent-child worksheets. 3. By a design-based approach, the solar system exhibition area and lunar meteorite exhibition area in planetarium are selected as the content for parent-child worksheet, then the worksheet is designed and applied.

**Keywords:** Informal learning, museum learning, worksheet, parent-child interaction

## 1. Introduction

With the popularization and development of the concept of lifelong learning, informal learning has drawn increasing attention as an important part of lifelong learning. Museum learning, as one of the main forms of informal learning, can provide a variety of museum activities to bring visitors a pleasant learning experience. Since the role of museum has transferred from collection to education (Zheng, 2015), the worksheet has gradually become a guide tool in the museum and provide guidelines to visits and study for various groups visiting the museum. This study will focus on the core issues of the parent-child worksheet in the museum, which are the little effect to learning and the insufficient parent-child interaction. By analyzing the visiting pattern of the parent-child groups and the their expectations of visits to the museum, building parent-child learning model, and designing parent-child learning based on this model, this study aims to promote parent-child interaction by parent-child worksheet, thereby enhancing their learning experience of visits to museum.

## 2. Investigation On The Current Context of Parent-Child Learning and Recognition of Worksheet in Museum

### 2.1 Questionnaire design

To investigate the current situation of learning in parent-child groups and their views on worksheets, this study reviewed and analyzed the dimensions of other questionnaires on museum learning, and drew on the dimensions of basic information, visiting purposes and the views on museums, etc. from the questionnaires on learning design in museums (Bao, 2013; Chen, 2013; Zhang, 2015). This study

includes the following five dimensions: the basic information, the expectations of museum, the museum learning habits, the role of parents, as well as the experience and attitudes of using. Based on these dimensions, the questionnaire of the parent-child learning method in museum was designed, which includes 16 questions (4 multiple choice questions and 12 single choice questions).

## *2.2 Implementation process*

The questionnaire was distributed to the visitors to planetarium randomly. The parents of the parent-visitor groups were required to fill in the questionnaires. The data collection lasted for six months from June 2016 to December 2016. 306 questionnaires are valid in 320 collected questionnaires. The effective rate of questionnaire is 95.6%.

## *2.3 Analysis and conclusion*

Museum learning orientation has guidance. Up to 68.30% of parents are likely to visit "with a plan or a map of the exhibits". But 26.47% of parents prefer to visit freely. Most parents regard their role as a "companion" in parent-child interaction, accounting for 57.76%. In addition, 23.56% of parents considered their role as a "guider". However, "experiencing exhibits", "participating in museum activities" and "discussing knowledge of exhibits" all exceeded 25%. Although the two findings seem contradictory, the author believes that parents acknowledge the educational functions of museum and expect to increase children's knowledge through visiting museum. Therefore, they give guidance to children during the visit, but their understanding of their role as guiders is not clear enough.

Lower worksheet utilization rate. Only 32.35% of parents used worksheets. This study investigated the experience of worksheet for parents who used worksheets and found that 80.81% of parents like to use worksheet, "suggested route" and "exhibit introduction" are the main reasons why parents prefer to use it; 13.13% of parents do not like to use worksheet, and "content design is boring" is the main reason. About 6% of parents hold a neutral attitude to worksheets.

After a simple introduction of parent-child worksheet to parents, 92.48% of parents are willing to use parent-child worksheet. There were 20.61% of parents who prefer the game-based worksheet, while the supporters of "question-based", "instruction-based" and "task-based" account for 10.75%, 8.06% and 9.68% respectively.

# **3. Model Building of the Parent-Child Worksheet in Museum Learning**

## *3.1 Parent-child worksheet's connotation and characteristics*

The worksheet enhances interaction among peers by prompting information about the environment or exhibits, and facilitating interaction among visitors, exhibits and visitors. Parent-child worksheet is a tool that can help parent-child groups study in museum. As a medium tool for museum learning, it not only has the characteristics of general learning list: guiding, intermediary and auxiliary (Yang, 2013). The author believes that the parent-child worksheet should have the following characteristics: (1) Guidance: The parent-child worksheet can provide visitors with a visit route or related knowledge guidance to help visitors better understand the design of exhibits and exhibition areas. (2) Intermediation: parent-child worksheet is the intermediary between visitors and exhibits during the visit to the museum. (3) Auxiliary: The parent-child worksheets help visitors actively and effectively complete the knowledge construction. (4) Interaction promotion: compared to other visitors, interactions of parent-child groups are more likely to be in the format of guidance of parents to children's learning.

## *3.2 Design principles of parent-child worksheet*

At present, the main problem of museum learning is that children cannot experience exhibits in depth or understand the connotation of exhibits. Although parents interact with their children, but it is not effective enough, which result in poor learning outcome. So the first principle of design of parent-child

worksheets is to attract children's attention. Meanwhile, it should support the interaction between children and parents, in order to enhance their experience of exhibits, facilitate a deep understanding of the connotation of the exhibits, and improve the learning effect in museum. The design principle of parent-child worksheet is shown in Table 1.

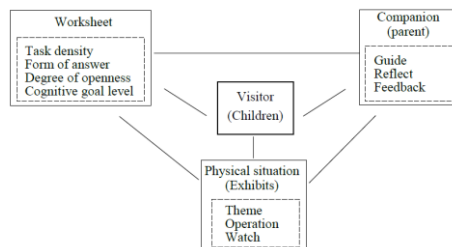
Table 1

*Design Principles of Parent-Child Worksheet*

How to attract children's attention	Setting the context	It can be subject-based, game-based, or an exploration model
	Relationship between problems and reality	Link the problems with practice to attract children's attention
How to promote parent-child interaction	Providing support or guidance for promoting interaction	Tips to discuss with parents; experience exhibits with parents
How to extend the children's learning behavior and guide the children to interact with the exhibits in depth.	The worksheet should be connected with the exhibits and the theme of the exhibition area.	The museum learning is relatively fragmented and non-systematic. The design of the worksheet can help visitors grab the central idea of the whole exhibition area.
	The worksheet content is limited. Visitors should be encouraged to think about other exhibits	There are four types of problems: memorial, convergent, divergent, and judgmental. Open questions can be set up (Chang&Wang,2014)

*3.3 Design model of parent-child worksheet*

John Falk et al. put forward that museum learning is rooted in personal contexts, physical contexts and sociocultural contexts, and it's an important theoretical framework for understanding visitors' autonomous learning in museum scenarios. They think that learning is that the museum visitors produce experience and meaning by continuous interaction and integration in the context of individual, physical and social cultural context to. The individual context will shape and be shaped in the physical environment across time, but they are both intermediated by social-cultural context (Falk, 2005). They believe that the interaction of the three contexts creates a new experience for the visitors and promotes the learning behavior in the museum. Under the background of the contextual model, the paper creates the learning context in museums through the worksheet, and promotes the interaction between parents and children, so as to improve the learning efficiency in museums. The parent-child worksheet's model draws lessons from the contextual model of museum learning, as shown in the following figure 1, sets the parent-child worksheets as a mediator, connects visitors, partners and the physical context and promotes interactions among the three elements, to help the visitor complete the meaning construction.



*Figure 1. The parent-child worksheet's model*

*3.3.1 Visitors*

In visit to museums, children's cognition and behavior habits are important factors in the design of the parent-child worksheet since they are the main target of parent-child groups. The level of cognitive development and gained knowledge are the preparatory work for the design of parent-child worksheet. The characteristics of the main users of parent-child worksheet need to be understood and analyzed. Expectation and interest, choice and control are the key points in the design of parent-child worksheet, with which the children's visit could be guided well.

### 3.3.2 Physical context

The design of physical context of the parent-child worksheet is based on the exhibits. Visitors interact with exhibits by watching, operating, getting feedback, etc., but the exhibits do not exist independently, they are part of the theme in the exhibition area. So the physical context includes three elements: watching, operating, theme. First of all, watching is for exhibits such as pictures, videos, real objects and models. Visitors mainly watch and touch the exhibits. The second is the learning activities of visitors around the interactive exhibits. Finally, the theme refers to the exhibition theme, parent-child worksheets should serve for the entire exhibition area, rather than one single exhibit.

### 3.3.3 Companion

In parent-child groups, children's peers are their parents. In order to assist the parent's leading role, three factors should be considered in the design of parent-child sheets: guidance, reflection and feedback. Guidance refers to the museum visits, the guide for parent in worksheets should provide help for parents on how to guide children learning; reflection is to help parents reflect on children's behaviors and mastery level of knowledge; feedback is that parents timely provide children with support and feedback to help them correctly understand the exhibits.

### 3.3.4 Parent-child worksheet

The content of parent-child worksheet includes task density, answer form, openness and cognitive goal. The task density refers to the time visitors spend on one exhibits or exhibition area. It also represents the difficulty of tasks, which should be set according to the current cognitive level of children; the answer forms of the parent-child worksheet are varied not limited to the form of filling, selection, but also include the form of the task and game, etc.; Openness refers to the range of answers. Mcloy and Grinder classify the content of the study into four types of questions: memorial, convergence, divergent and critical questions (Chang & Wang, 2014). Parent-child worksheet should pay attention to the openness of questions, take into account the majority of exhibits in the museum; Cognitive goal means the setting of questions should be purposely and clarify the cognitive level of the questions, which should be set based on the cognitive level of visitors.

## 4. Design and Practice of Parent-Child Worksheet in "Beijing Planetarium Hall Solar System Exhibition Hall"

### 4.1 Design process

The solar system exhibition hall was selected as the content foundation of parent-child worksheet design, and 6-8 aged children and their parents were chosen as objects. In order to assist the design of parent-child worksheet, this study designed the template of parent-child worksheet, as shown in the following table 2, table 3 and table 4.

Table 2

*Template of Parent-Child Work-Sheet*

The theme	The solar system
User age	6-8 years old
The theme of exhibition	The sun's family
Characteristics of Children's cognitive development	From the preoperational stage to the concrete operational stage
Child's prior knowledge level	The school does not offer science courses, and children have no systematic knowledge of astronomy. However, according to the interview, parents lead their children to visit the Planetarium two or three times a year.
Content analysis of the exhibition area	Describe the volume, mass, period, gravity acceleration of the sun and the eight planets, and provide visitors with scientific knowledge about the solar system.

Objective of parent-child worksheet	Knowledge and skills	Know the name and arrangement of the eight planets; know the planet's rotation and revolution period; know the planet's mass and volume
	Emotions, Attitudes and Values	Establish an objective understanding of the solar system Build interest in astronomy

Table 3

*Item Design of Parent-Child Worksheet*

	Cognitive target hierarchy	Cognitive target	Question type	Involved Exhibits and their number	The subject content
One	Know	Know the earth's knowledge	Game	Solar system model, earth model, List of planetary revolution period; three	Find out where the earth is.
Two	Remember	Know the order of the eight planets	Painting	Solar system model; one	Please draw the eight planets in the order of distance from the sun.
Three	compare	Understand the planet's revolution; Compare the planet's revolution period	Fill in the blank	List of planet revolution period; one	Which planet runs the fastest?
Four	Compare	Compare the size of the planet	Fill in the blank	Pictures to introduce eight planets, solar system model; nine	Which planet is the largest?
Five	Know, understand	Understand the meaning of gravitational acceleration; know the gravitational acceleration of the planet	Question and answer	Physical models of eight planets; eight	On which planet, a basketball is the heaviest? Why?
Six	Analyze	Analyze Earth's revolution and rotation; understand the effects of revolution and rotation	Question and answer	Physical model of earth; one	Why there are days and nights? Why there are four seasons?

Table 4

*Parental Guide-Sheet Content Design*

	Question answer and explanation	The location of the exhibits	Guidance advice
One	Solar system model, earth model, List of planetary revolution period	Model of solar system, and earth, List of planetary revolution period	Look for exhibits with your children and communicate with them about the exhibits you find.
Two	Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune	Model of solar system	Accompany your child to see the eight planet models and memorize the order of the planets
Three	Mercury is the closest to the sun, The faster the revolution of the planet is, the smaller the cycle is.	List of planetary revolution period	Watch the exhibits and explain to your child the relationship between revolution, revolution period, and speed
Four	Jupiter is the largest and Mercury is the smallest	Pictures to introduce eight planets; model of solar system	Introduce scientific notation, or lead children to watch the model
Five	Jupiter, the weight of the basketball is related to the planet's gravitational acceleration, The greater the acceleration of gravity, the greater the weight is.	Physical models of eight planets.	Explain the meaning of gravitational acceleration to your child and compare the magnitude of the gravitational acceleration on different planets
Six	While the earth rotates, it also revolves around the sun.	Model of earth	Role-play with children, simulate Earth's rotation and revolution, and explained by stages

*4.2 Feedback and revision*

Five families who wished to use parent-child worksheet were randomly selected in the planetarium, and the children in the family are between 6 and 8 years old. In order to investigate the satisfaction of worksheets of parent-child groups, interviews were conducted. The following are the interview questions: (1) How often do you talk with your child about the exhibits? (2) What do you think about the guidance function of parent-child worksheet in museum learning? (3) Can you answer the child's

questions better through the parent-child worksheet? (4) What do you think about the effect of museum learning with parent-child worksheets? (5) What are your comments and suggestions on parent-child worksheets?

The summary of the parents' opinions in the first round of research indicates two aspects: Firstly, the content design of parent-child worksheet is not attractive to children; secondly, a small number of exhibits are included in the parent-child worksheet, which restricts the visitors' visits. Based on the above questions, the parent-child worksheet and parental guide-sheet are revised; the result is shown below in figure 2 and figure 3.

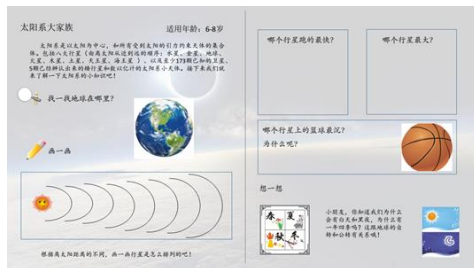


Figure 2. Revised Parent-child Worksheet



Figure 3. Revised Parental Guide-sheet

## 5. Conclusion

In the museum learning, the parents will discuss or experience the exhibits with the children. However, most parents do not have enough understanding of their guiding role in the visiting process. Parent-child worksheet, as support for parent-child group learning in museums, could help parents guide children's learning, promote parent-child interaction, guide children visit effectively and learn more about the exhibits, thereby enhancing the museum learning.

## Acknowledgements

We would like to thank all the people who prepared and revised previous versions of this document.

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