

# Redesigning Children's Learning Experience Based on Persuasive Game : A Case Based on "Little Explorer of Hunan Embroidery"

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Nowadays, children are attaching more and more importance to the learning of various cultural heritages. However, It is the nature of children to play. They can't concentrate for long on the cultural knowledge they are not interested in. "Game" has become one of the effective ways to change this situation. Persuasive game design, as one of the methods of behavior change design, aims to create a user experience game world by using gamification, in order to change the user behavior in the real world. Based on the Hunan Embroidery Museum's cultural leaning project, this study explored the possibility of persuasive game design to promote the positive change of children's learning behavior, and combined with profound experience design, redesigned the traditional cultural learning course - creating immersive learning experience for children through gamification. The results show that reasonable and interesting persuasive games can improve children's learning motivation, stimulate the flow, and promote them to achieve positive changes in learning behavior and enter into an immersive profound learning experience. This study verified the positive effects of persuasive game design and deep experience design on children's learning and personal development with practical projects, and provided some new ideas for the design practice of persuading children's behavior change.

**Keywords:** *persuasive game design; flow; profound experience design; value*

## 1 Introduction

In recent years, discussion and research on persuasive game design (PGD) have been growing. Many studies have shown that this method of using gamification to motivate users to achieve targeted behavioral changes is highly available. Therefore, PGD is applied in various fields, such as medical health (De la Hera, 2018), social interaction (Visch, 2017), education and learning (Alahäivälä, 2017), etc.. Among them, PGD is relatively rare in the field of education and learning, but it has great potential. Children are one of the major groups receiving education, and their early education will lay an important foundation for their future development and lifelong learning. However, children in the early school age (6-9 years old) are at the peak of their psychological and physical development. They are impulsive in learning, poor self-control, attention is difficult to focus for a long time and other problems, but at the same time they carry the "love to play" nature -- lively and active, strong

curiosity, thirst for knowledge, strong performance, love to ask questions, love to imitate and so on. Children's learning motivation is easy to be induced in the rich and vivid life situation, and the plasticity is strong. It can be seen that the traditional formal learning style is not entirely suitable for children in the early school age, not only can not stimulate their interest in learning, but also stifle their imagination and creativity. On the contrary, game-based learning is a breakthrough that can effectively stimulate children's interest in learning and improve learning performance. Therefore, this paper explores the relationship between PGD and children's learning behavior, and verifies the possibility that persuasive games encourage children to learn positively. At the same time, we also combine PGD and profound experience design (PED) to explore the influence of immersive learning experience on children's future development.

This study is based on the Children's Hunan Embroidery Culture Learning Project of Hunan Embroidery Museum in Shaping Township. It aims to stimulate children's interest in traditional handicrafts through the study of Hunan embroidery, cultivate hand-brain coordination ability, improve concentration, and comprehend the spirit of Hunan embroidery contained in culture. However, as a national intangible cultural heritage, Hunan embroidery is very complicated and difficult to learn because of its profound culture and exquisite craftsmanship. At first, the museum adopted a more traditional teaching method. The museum's lecturer led the children to visit the museum. After briefly introducing some contents about the Hunan embroidery, they asked the children to complete the embroidery work that was distributed. According to the actual research data in the museum, we observe that this traditional method is very infeasible and cannot achieve the expected learning effect of the project. Therefore, the research team used the PGD and PED as the theoretical basis and methodology to redesign the Hunan Embroidery Culture Learning Project - "Little Explorer of Hunan Embroidery". Through the experiment, we found that PGD can transform the serious learning knowledge of the real world into various game elements of the game world through the gamification, which improves children's learning motivation and concentration, stimulates the flow, promotes the positive change of children's learning behavior, and makes them to enter a pleasant and immersive learning experience - the profound experience. At this time, on the one hand, children can effectively complete the learning (game) goal and carry out a series of good social interactions, thus generating a sense of achievement and happiness. On the other hand, children can absorb and comprehend the deep meaning (the spirit of Hunan embroidery) in the profound experience, and make these meanings transfer to the real world imperceptibly. The spirit they learned will strengthen and maintain children's positive learning behavior, and it is conducive to the shaping of children's values and the development of their personalities.

## **2 Related Work and Thories**

### **2.1 Persuasive Game Design (PGD)**

The theory of persuasion can be traced back to the ancient Greek rhetoric philosophy based on verbal persuasion (Bogost, 2007). After the rise of communication science in the 20th century, rhetoric began to be used in other fields, such as advertising, to persuade users to consume goods in television advertisements. With the development of interactive media such as games, Bogost (2007) put forward the theory of "procedural rhetoric" - running processes and executing rule-based symbolic operations. The theory is that games can make strong claims about how the world works - not just through words or vision, but

through the processes they embody and the models they build. Bogost (2007) argues that it is this aspect of interaction found in games that provides users with the motivation to change, and thus forms the "persuasive game". Later, other researchers continued to develop the theory of persuasive games. Sicart (2011) proposed a new game theory to complement the existing concept of procedural rhetoric - persuasive games should engage with existing game rules, focus on instrumental game elements, or the way players choose. De la Hera (2013) adds a more convincing dimension to Bogost's procedural rhetoric, including narrative persuasion involving components such as stories and characters, and film-style persuasion involving components such as frames.

Valentijn Visch et al. (2013) officially proposed the persuasive game design and its general theoretical model in 2013 (Figure 1). Though "playing games", users can transfer the experience of the real world to the experience of the game world, and the gameplay of the game world can promote and "persuade" users to achieve the target behavior change in the real world. In the real world and the game world, individuals are driven by the same motivational needs: the need for autonomy, ability, and social relationships controls their behavior (Ryan and Deci, 2000). In the real world, individuals must work very hard to meet the satisfaction of their needs, but the game world is clearly designed to meet these needs, which leads to a typical immersive and satisfying experience in the game world (Przbylski, Rigby and Ryan, 2010). Therefore, "persuasion" in persuasive games can be considered as the behavioral motivation designed for users in the interactive game world, which can promote users to conduct behavior change in the real world (Siriaraya et al., 2018). In the PGD model (Visch, 2013), this behavior change is called "transfer effect", which is defined as the change effect of users' expectation caused by gameplay, from changing users' attitude towards specific problems to changing users' lifestyle. Most of the existing research on PGD focuses on encouraging healthy lifestyle (De la Hera, 2018) and promoting social interaction (Visch, 2017), but relatively little on children's education and learning.

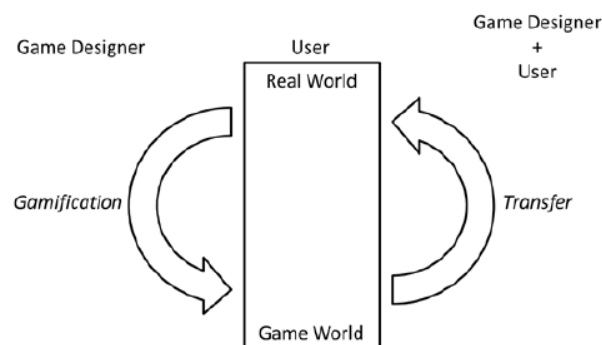


Figure 1. Persuasive Game Design (PGD) Model.

## 2.2 Profound Experience Design (PED)

Experience design (XD) is a solution that focuses on user experience and culture in the fields of designing products, processes, services, activities, marketing and environmental design. Experience design enables designers to gradually transform from designing users' lifestyle to designing the meaning of users' life. In the book *Profound Experience Design* (Jesper, 2014), Jesper (2014) proposes three dimensions that together form the integrity of the experience (Figure 2): instrumental dimension, use-experience dimension, and profound

dimension. The instrumental dimension focuses on products that facilitate other dimensions. It is tangible, often a physical creation. The use-experience dimension focuses on the processes and actions in the experience, that is, the process by which the user interacts with the product. The profound dimension is when the user is completely immersed in it - "At least that's what you do if the use-experience is well designed, so the smooth and natural interaction allows you to forget all about the product and just 'enjoy the experience'" (Jesper, 2014). Hassenzahl (2013) proposed a similar division, describing the three levels of design considerations when analyzing the experience of making coffee using a French filter coffee maker: why, what and how (Figure 2). These levels correspond to the concept of experience dimensions discussed above.

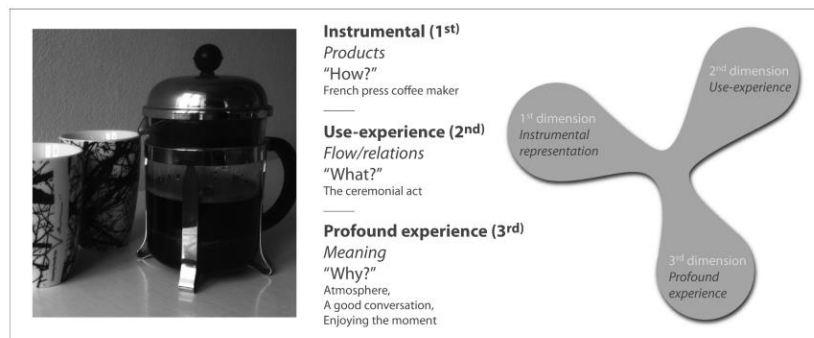


Figure 2. The three dimensions of an experience exemplified by a French Press Coffee Maker.

Jesper (2014) built an Experience Scope Framework (ESF) based on two basic orientations and two fundamental influences of profound experience. He portrays this deep dimension of the design framework as a two-by-two matrix that juxtapose omni and goal orientation along the one axis and the direct and derived effects along the other (Figure 3). The ESF is directly applicable in a design process, providing a structured way to explore a broader scope of the experience at a profound level. Making the orientations and effects of an experience more explicit - as well as working directly with the switch between them - improves the potential to start designing from a profound experiential level (Jesper, 2014).



Figure 3. ESF of Profound Experience Design.

However, the current study on PED is still related to product design, service design and so on. There is little or no study on children's learning experience and the combination with PGD. Therefore, while validating the effectiveness of PGD in promoting positive change of children's learning behavior, this study also explored the relationship between PGD and PED, and based on this, designed the "Little Explorer of Human Embroidery" manual activity.

### **3 Methods**

Various studies show that children of different ages have different levels of physical function and cognitive development. The early school age is the most vigorous period for children's psychological and physical development, and also an important period for children to form their character and behavior habits. So, this study selected children aged 6-9 years old as primary subjects. The entire study is divided into two phases: preliminary research and PGD experiment. In the preliminary research stage, through field visits and surveys, we learned about the general situation of the Hunan Embroidery Museum, observed the learning behaviors of children using traditional learning methods, and found the design problems that need to be solved and improved. In the PGD experimental stage, through questionnaires, observations, semi-structured interviews, etc., we observed and recorded the learning behavior of children in a relaxed and joyful game situation, and analyzed and verified the expected experimental results.

When we conducted field visits and surveys, we participated in and observed a complete Hunan embroidery learning course with the assistance of the staff of the Hunan Embroidery Museum. The researchers were divided into two groups - the observation group and the interview group, each group assigned 2-3 people. The observation group recorded the specific situation of the Hunan embroidery learning course and the performance or behavior (language, expression, movement, etc.) of the children in the course by text and audio-visual images. The interview group randomly interviewed several children and the staff in the museum to know their views on the Hunan embroidery learning course and recorded them by means of recordings and texts.

The PGD experiment was carried out in Changsha Municipal Library, which launched a manual activity named "Little Explorer of Hunan Embroidery". Through a notice posted on the library's website, we invited 10 children to participate in the experiment. The children were randomly divided into three groups to play the game. Each group set up an observer, who accompanied and assisted the children to play all the time, and observed and recorded the children's performance and behavior. For better observation, we used a multi-scan method of tabular recording and video recording, which is a sampling method for children's social behavior research. In this experiment, each child had an independent record sheet. Each group's observer needed to take turns to observe each child in the group and record the child's performance and behavior in the table. Observers recorded children's performance and behavior from four aspects: knowledge acquisition (learning) behavior, social interaction behavior, emotions and motivation, motor skills and attitudes. In addition, the researchers used the phone's camera to capture children's gestures, facial expressions and other nonverbal communication during activities, and set up a fixed-position camera to help record behaviors that might be overlooked. During and at the end of the activity, we conducted semi-structured interviews with several children and their parents to investigate their views and suggestions on the activity. Due to time and venue constraints, we decided to conduct an online questionnaire survey, and separately used the parent questionnaire and the child questionnaire to collect their feedback on the experience of this activity.

## 4 Research and Results

### 4.1 The preliminary research

In order to investigate the current situation and problems of the traditional Hunan embroidery learning course in Hunan Embroidery Museum, we we adopted the method of field visit and survey, and set observation group and interview group:

- Observation group: participated in and observed a complete learning course, and recorded the children's learning performance and behavior.
- Interview group: conducted informal interviews with some children and staff to investigate and record their views on Hunan embroidery learning course.

#### 4.1.1 Current situation and problems of Hunan embroidery learning course

Hunan embroidery is a national intangible cultural heritage. In order to inherit, protect and revitalize the Hunan embroidery industry, the Hunan Embroidery Museum was established as a national cultural center and a scientific education practice base. Subsequently, the museum opened a series of Hunan embroidery learning courses for primary and secondary school students. The course is divided into six parts: Exploration, Visit, Research, Study, Perception and Practice. It aims to let children feel the charm of hunan embroidery culture, and at the same time, cultivate their spirit of struggle, perseverance and excellence.

Researchers made an appointment in advance to conduct a field survey of the Hunan Embroidery Museum. We followed the primary school team that visited that day and participated in a complete Hunan embroidery learning course. The museum has four floors: Hunan Embroidery Introduction Area (1st Floor), Collection Exhibit Area and Embroidered Mother's Handicraft Workshop (2nd Floor), Hunan Embroidery Sales Area (3rd Floor), and Learning Experience Area (4th Floor). Under the guidance of the museum's lecturers, the children officially started their learning course. We show some photos taken in the museum in Figure 4.



(a)



(b)



(c)



(d)

Figure 4. The photo of Watching the Hunan embroidery's video (a). The photo of visiting the museum on the 1<sup>st</sup> floor (b). The embroidery mother's workshop (c). An already completed embroidery work by a student (d).

Through observation and interviews, we found several major problems:

1. A large number of students visiting the museum at the same time. It is too crowded and difficult to manage.
2. The propaganda films played in the hall were dull and did not quite fit the learning course.
3. Traditional teaching model can not stimulate students' interest in learning. Their learning focus and learning efficiency are low.
4. The route of the museum is haphazard and there is no clear learning goal.
5. The pattern of the manual experience is too old-fashioned, the color is monotonous, and the students are not interested.
6. The time allocation for the entire learning course is unreasonable.

In addition, the Hunan Embroidery Museum itself has problems in terms of geographical location, reservation mode, site layout, staff arrangement and so on.

#### 4.1.2 Characteristics of children's learning performance and behavior in traditional learning course

Hunan embroidery learning course is mainly composed of traditional museum visit and manual practice experience. The museum visit is led by the lecturer. The students mainly understand the general situation of Hunan embroidery from the posters and explanations on the wall. Some related objects and Hunan embroidery works are displayed in the museum for students to watch and take pictures. The manual practice experience part is taught by embroidered mothers. Subsequently, the students were divided into groups and each group was given a set of embroidery kits. They are required to finish the Hunan embroidery work within a certain time. Through observation and some informal interviews, we can roughly understand the learning performance and behavioral characteristics of children in each link of the traditional Hunan embroidery manual learning course, and record some dialogues (table 1):

Table 1 Record of children's learning performance/behavior in each link of Hunan embroidery learning course.

	Learning Performanc & Behavior	Dialogues
Exploration (Video)	Small part: listen and take notes Most: daze, chat, play cell phone...	"It's so boring, what are you doing?" "Checking Weibo, have you seen today's news..."
Visit (1 <sup>st</sup> Floor)	Small part: active participation and interaction Most: wander aimlessly, take selfies, do other things...	"Hey, come over! Let's take a selfie together!" "OH! They are so old-fashioned!"
Research (2 <sup>nd</sup> Floor)	Form a small group to wander around	"It's so boring, how long will it take?"
Study (2 <sup>nd</sup> Floor)	Show a certain interest and closely observe the embroidered mother	"How long do you need to embroider this? Can you let me see how it is embroidered?"

Perception (3 <sup>rd</sup> Floor)	Compete with friends for the price of Hunan embroidery products and find higher-priced products	"You look at it! This is actually more than ten thousand!" "I am looking for this more expensive than yours!"
Practice (4 <sup>th</sup> Floor)	Feel difficult and don't want to embroider after embroidering for a while	"I didn't understand, I could not finish it." "How do you do this..." "Time is running out. I don't want to embroider."

According to Table 1, in the learning course, only a small number of students will actively participate in it, while most of them will find the course "a little boring", unable to learn or even unwilling to learn. In short, the traditional teaching methods adopted by the Hunan embroidery learning course cannot stimulate children's interest in learning. At the same time, the visiting route of the museum is chaotic and there is no clear learning goal for children, which makes the learning atmosphere very loose and blind. As a result, children's learning participation and learning efficiency are very low.

#### **4.2 PGD experiment: "Little Explorer of Hunan Embroidery"**

According to the problems found in the museum research, in order to improve the learning experience of children and improve their learning participation and efficiency, we have redesigned the Hunan embroidery learning course by means of gamification. We launched the "Little Explorer of Hunan Embroidery" manual activity in Changsha Municipal Library, let the children learn the hunan embroidery culture in the relaxed and joyful game situation, and observe their learning performance and behavior. The activity was initiated online by the library and consisted of 30 participants, including 10 children (6-9 years old, 2 boys, 8 girls), 10 parents (1 father, 9 mothers), 2 teachers, 5 observers, 2 organizers and a young Hunan embroidered mother. Ten children were randomly divided into three groups (A, B, and C) by lottery, and each group was set up with an observer for observation and assistance.

##### **4.2.1 Experiment Procedure**

The persuasive game in the manual activity of "Little Explorer of Hunan Embroidery" is set in the story of Grandma Hu, a Hunan embroidered mother in the qing dynasty, who travels through time to find memories. The children in each group need to go through the five game levels set by us to obtain "memory embroidery fragments", synthesize "time stones", send Grandma Hu "back to qing dynasty" and win prizes/gifts. The specific game settings and processes are shown in Figure 5.




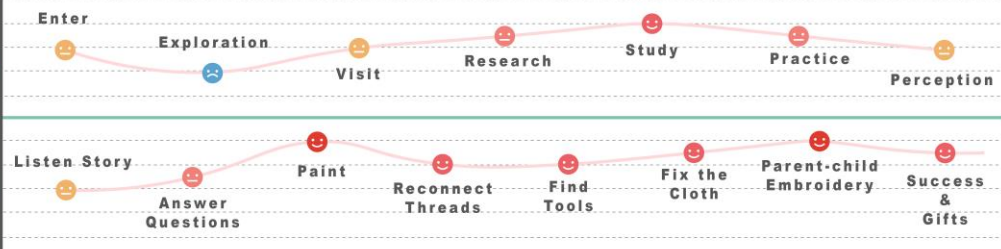
 <b>Early school age children</b> 8 girls 2 boys	<b>Game Levels</b>	<b>Enter the Room</b>	<b>Storytelling and Grouping</b>	<b>Memory Embroidery Cloth</b>	<b>Memory Embroidery Manuscript</b>	<b>Memory Embroidery Thread</b>	<b>Memory Embroidery Tools</b>	<b>Fix the Cloth on Embroidery Frame</b>	<b>Memory Embroidery Fragments</b>	<b>Success and Gifts</b>	
	<b>Game Goals</b>	1. Get and fill the name in challenge certificate 2. Know the rules and announcements of the game.	1. Listen and Know the story background 2. Lottery & grouping (A#B#C#) 3. Extract pattern template	1. Lottery the problem card 2. Watch a short video and answer questions on the problem card 3. Answer correctly to obtain an embroidery cloth	1. Draw the pattern within the specified range of embroidery cloth 2. Get "Regulation" sticker	1. Untie the knotted thread and reconnect it 2. Get "Patience" sticker	1. Find all the tools hidden in the painting 2. Get the embroidery tool kit	Follow the embroidered mother to fix the cloth on the embroidery frame	1. Embroidery within the specified time 2. Get "Perfect" sticker	1. Find the "time stone" and paste it to Grandma Ma's headscarf! 2. Get "Morality" sticker and Gifts	
	<b>Time</b>	5min	10min	15min	20min	10min	10min	10min	30min	10min	
	<b>Touch Points</b>	challenge certificates, rule cards	hand-painted story books, group stickers, pattern templates	Computer (Video), question cards, embroidery cloth	Watercolor pen, template, embroidery cloth, "Regulation" sticker	Knotted thread, "Patience" sticker	Illustration, watercolor pens, embroidery tool kits	embroidery cloth, embroidery frame	tools for embroidery, "Perfect" sticker	embroidery works, the "time stone", handicraft, "Morality" sticker, gifts	
	<b>Correspondence with Traditional Learning Course</b>	<b>Exploration</b> Know the knowledge about Hunan embroidery before the official visit in the museum (video)			<b>Research</b> Research Hunan embroidery from various aspects		<b>Study</b> Follow the embroidered mother to learn the needlework of Hunan embroidery		<b>Practice</b> Complete the embroidery works with the knowledge		
	<b>Learning Experience (Traditional)</b>	<b>Visit</b> Guided by the lecturer to visit the museum floor 1-4   <b>Perception</b> Feel the charm of Hunan embroidery and comprehend its spirit									
	<b>Learning Experience (PGD)</b>										

Figure 5. The specific game settings and processes of "Little Explorer of Hunan Embroidery".

Data of this experiment will be collected during and after the activity. During the activity, the observer of each group took turns to observe each child according to the four aspects of the observation record sheet, and recorded their learning performance and behavior. When necessary, the observers need to take photos and recordings with their mobile phones to capture the subtle gestures, expressions and verbal communication of the children during the activities. In addition, a fixed camera was placed at the back of the field to record the whole process, so as not to miss some unobserved behavior. At the end of the activity, each child's work was photographed. We will show a part of the embroidery works by children and the photos of the activity in Figure 6.

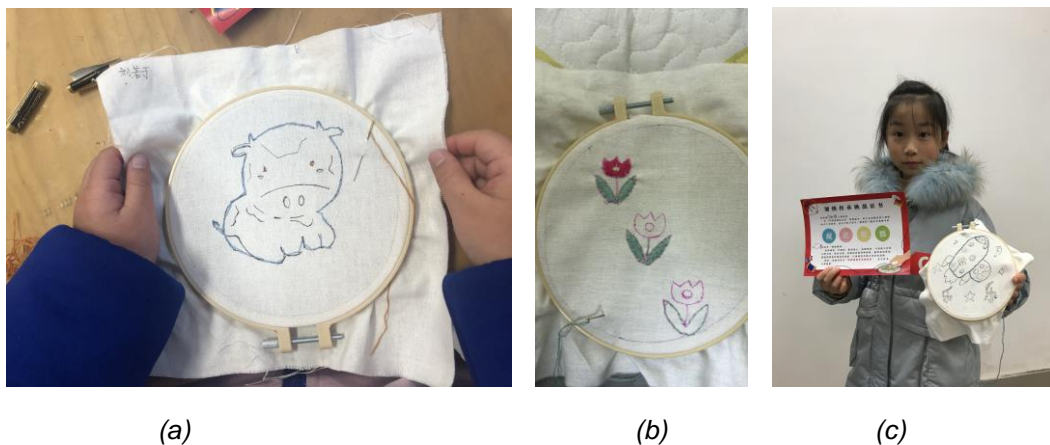




Figure 6. The embroidery works by a boy (a) and a girl (b). The photo of the completed challenge certificate and embroidery work by a cute girl (c). The photos of the activity (d)(e)(f).

After the activity, parents and children need to fill in a questionnaire to let us know their feelings and suggestions about the activity -- to verify the expected experimental results.

## 4.2.2 Experimental results

### 4.2.2.1 Persuasive game can improve children's learning motivation and efficiency.

Learning motivation is a series of learning challenges and learning objectives to guide, stimulate and maintain the learning activities of the internal process or internal motivation. Keller(1987)'s motivation model (ARCS) proposes four elements of learning motivation: attention, relevance, self-confidence, and satisfaction. Relevance refers to the fact that when the learning content is closely related to the learner, they usually show greater interest. Self-confidence is the third element that motivates and sustains learning motivation. Satisfaction is an important condition for learners to generate continuous learning motivation.

The traditional Hunan embroidery learning course, on the one hand, does not provide children with clear learning challenges and goals, and uses a boring teaching method that does not cause children's interest in learning. On the other hand, the learning content provided by the museum is too difficult for children. It is difficult for children to understand, and it is easy to make them lose self-confidence and satisfaction. However, "Little Explorer of Hunan Embroidery" activitie, through the gamification of PGD, transforms the real world's learning content into various game elements of the game world - bizarre storyline, mysterious rewards and gifts, difficult and different Challenge tasks, team cooperation, etc., in order to attract and guide children, stimulate their interest in learning, let them actively learn and explore new knowledge. In addition, this game is designed according to children's cognitive and physical skills, with moderate difficulty and high playability, so that children will have self-confidence and satisfaction when finishing the game.

Persuasive games make serious learning as easy and fun as playing games. The boring and tedious knowledge becomes vivid and interesting - more easily absorbed and mastered by children.

### 4.2.2.2 Gamification will stimulate the flow and promote a positive change in children's behavior.

When proposing persuasion techniques, Fogg (2009) pointed out that motivation, ability and triggers are indispensable for changing a target behavior. The various game elements of

persuasive game enhance the internal and external motivations of children's learning. At the same time, in the design of the game level, the designer simplifies and clarifies the children's learning tasks, improving the children's learning ability and the possibility of completion. In addition, gamification as an incentive mechanism acts as a trigger in behavioral change, guiding people to produce purposeful behavioral changes. In the activity of "Little Explorer of Hunan Embroidery", the main target behavior change is to guide children to change from distracted learning state to immersive learning state. The flow is the state of mind that occurs when a person concentrates on an activity (Mihaly, 1990). Therefore, motivating children to enter an immersive learning state requires arousing the flow (Figure 7).

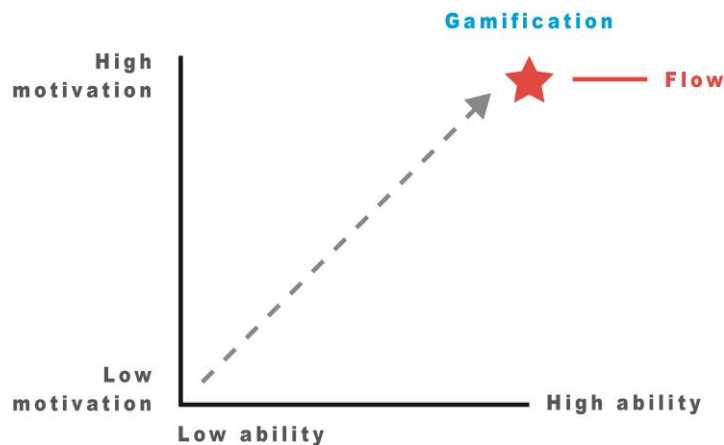


Figure 7. The relationship of Motivation, Ability, Trigger (Gamification), Flow.

The flow is a sense of accomplishment achieved through a perfect balance between challenge and skill (Mihaly, 1990). Wang Ning (2017) studied the stage of motivation formation and divided the relationship between individual motivation and cognitive development into four stages (Figure 8). He believed that individuals will reach the state of flow after experiencing the four stages of activity.

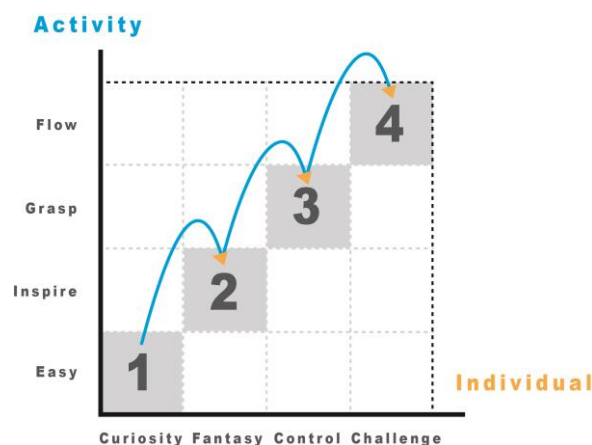


Figure 8. The four stages of motivation.

In the Hunan embroidery PDG experiment's first stage, children are introduced into the game situation of "grandma hu crossing" by means of storytelling to stimulate their curiosity. In the second stage, open learning environment is given to children, allowing them to explore, try and create freely in the game world, stimulating their fantasy of learning. The third stage is to guide children to "learn by doing", and let them learn and practice the knowledge and

skills in the game levels. In the fourth stage, children use the knowledge they have acquired before to complete the embroidery work with the help of their parents and teachers, and obtain a sense of accomplishment.

Through four stages of motivation formation, children's psychological activities start from "easy" at the beginning, continue to "inspire" to gradually "grasp", and finally reach "flow" -- the perfect balance of learning challenges and skills. Children enter a state of immersive learning.

#### **4.2.2.3 Persuasive games allow children to enter profound experience and generate happiness, which is conducive to shaping their values and personalities.**

According to the relevant theories of PGD and PED, we found that designer's purposeful persuasive game design can guide people into profound experience and transfer the behavior change and deep meaning in experience to the real world. Based on the experience scope framework (ESF) and the PGD model, we made a specific analysis of the PGD experiment of Hunan embroidery (Figure 9). First, we found that the gamification of persuasive games is significant for the two basic orientations of deep experience:

- Gamification provides specific learning goals, improves learning motivation, promotes children to work hard to achieve goals, and finally enables them to obtain rewards and a sense of achievement.
- Gamification builds a relaxed and pleasant learning environment, allowing children to explore in the game world openly, freely interacting with others, and let them feel happy and joy.

Secondly, through field observation and questionnaire results, we found that the direct impact of persuasive games is to promote the positive change of children's learning behavior, so that they can enter into an immersive learning state and generate happiness. On the other hand, in the process of activities, children imperceptibly feel and absorb the deep meaning contained in the experience - "Hunan embroidery spirit". This will play a positive guiding role in shaping its future values and personality. Although, at this moment, they are not able to understand what it means, but in the future one day, a certain scene, they will have "insight" to these "spirit" and use it for their own.

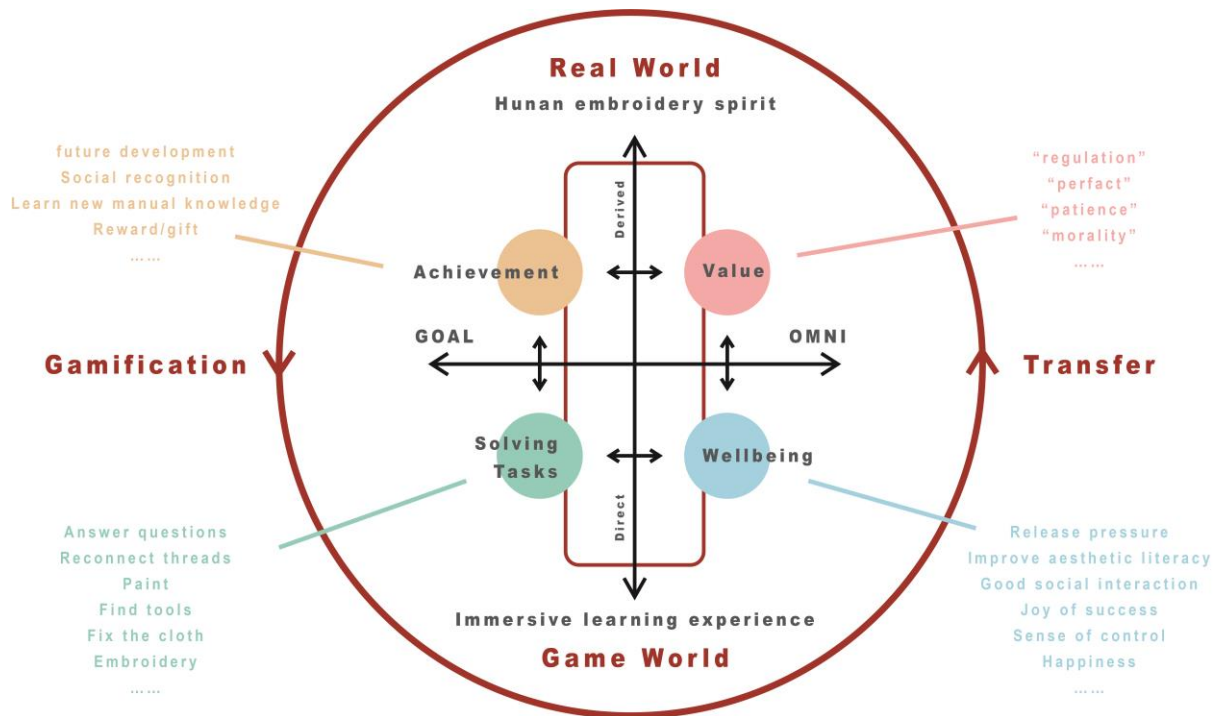


Figure 9. The relationship of the PGD model and the PED's ESF.

In short, in the Hunan embroidery PGD experiment, the designers use gamification to transform the knowledge of the real world into various game elements of the game world. The design of the game level is difficult and moderate, so that children can learn the embroidery skills and manual skills step by step and modularity. At this time, children's concentration is high, which stimulates the flow. This will allow them to ignore the existence of time and space, and completely immerse themselves in the experience of the game world - into the deep experience of learning. In addition, the experience in the game world not only promotes the positive change of children's learning behavior, but also enables them to absorb and comprehend the deep meaning in the experience, and make these meanings transfer to the real world imperceptibly, which plays a positive role in children's future development and growth.

## 5 Conclusion

This study uses gamification as a starting point to explore the connection between PGD and PED. The game elements that can trigger the change of children's learning behavior are associated with the needs and abilities of children in the learning experience of cultural heritage, and the traditional learning course is redesigned and practiced. When designing a persuasive game, the designer should consider the child's learning motivation, learning ability, learning style, learning content and game genre, and adjust according to the implementation scene and the actual situation of the object. Finally, this study verifies the promotion effect of persuasive games on children's learning. Gamification can stimulate flow, guide children into immersive learning experience, let them feel the sense of achievement and happiness while acquiring knowledge and skills, and have a positive impact on the shaping of their values and personality.

Persuasive games make full use of children's "playful" nature, making children "addicted" to learning in the process of "playing games". Designers should focus on designing more open and interesting learning scenarios, reasonable and appropriate challenges and feedback, more opportunities for competition and cooperation, and time for children to internalize and reflect. This will encourage children to actively learn knowledge and skills at the same time, imperceptibly absorb and comprehend the spiritual connotation of learning experience.

This study was limited in the aspects of venue, time and personnel arrangement. There is a lack of rigor in the design of experimental activities and data collection. In addition, the derivative effect of learning deep experience needs to be observed for a long time, and the current research results still need to be further verified.

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