

# The study on playability of toys for children based on different temperaments

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**Abstract:** Children gain knowledge through internalization, adjustment, and construction of individually contact with surrounding environment. During infant phase, a game is life, and life is a game. Toys have become a powerful tool to facilitate children's growth and learning. Besides, Children are born with their natural style of interacting with or reacting to people, places, and things—it is their temperament. Children with different temperaments need different teaching aids in their development. To promote effective learning and in order to stimulate their interest in games, it is important to select appropriate toys for the children with different temperaments. It would help to improve learning effects if adults timely provide children with help and guide. To achieve the above targets, this study aims to build the relationship between child temperament and toy categories in order to discuss the playability of toys for children based on different temperaments. Study steps are as follows : (1) Classify preschool children by temperament test, and pick up representative toys as the experimental samples according to Piaget's game theory. (2) Discuss with experts in EGM and extract the possible playability of toy from it. Classify and arrange data with Factor analysis. (3) When observing the preference of children picking different sort of toys, confirm the attractive factors for playing games continuously by arranging the possible playability with experts. (4) The operating time and frequency of playing toys would be recorded in the experimental procedure. (5) Study if there was preference of different temperament children for toy categories, and build the connection between the playability of toys and temperament of children. This study builds the relationship between child temperament and toy categories in order to discuss the playability of toys for children based on different temperaments. It provides childhood educator a reference to choose toys, but also a design guideline for toy designer.

**Keywords:** temperament, toy, preference

## **1. INTRODUCTION**

With improvement of technology and the trend toward fewer children, requirement of children have been taken seriously gradually. Various kinds of expensive toys are there in the market, but not all of them are good for stimulating children's ability development. Some of the toys are only even decoration, or they are only designed with a couple of ways to play with which will lose players' curiosity soon. Under the circumstance of not long enough of playing time, children will not be able to develop different type or level of game content through deep exploration. (Johnson, Christie, & Peckover, 1988)

Thus, for adults, especially for preschool education workers like kindergarten teachers or babysitters, they should pay more attention on the principle of the right age, the right ability, and the right personality between children and toys when they are picking toys for children. According to Piaget's game theory, (Piaget, 1962) Children who are at different phase of cognitive development will play games with different ways, and, in turn, games simultaneously reflect children's level of development at the moment. Besides of the cognitive development differences, each child was also born with different kinds of temperament. The definition of temperament is that it is a natural born, unique behavior pattern that stimulates internal or external reaction. It has nothing to do with IQ or future achievement, but it will affect infants' personality development.

## **2. LITERATURE REVIEW**

### **2.1. Game theory**

According to Cognitive-developmental theory of Piaget, children gain knowledge through internalization, adjustment, and construction of individually contact with surrounding environment. However, during infant phase, a game is life, and life is a game. Toys have become a powerful tool to facilitate children's growth and learning.

Piaget had divided children's cognitive development into 4 phases, which are sensorimotor, preoperational, concrete operation, and formal operation phase. By explaining toys with perspective of cognitive development, he thought that cognitive development would affect children's games playing behaviors and divided those behaviors into three phases which are Practice play, Symbolic play, and Game with rules. After that, Smilansky, based on Piaget's categorization, revised cognitive games into four types. He changed Practice play with Functional play, and added Constructive play between Practice play and Symbolic play. He also changed symbolic play with Dramatic play. The last one remained Game with rules.

The four phases which cognitive development would experience are kind of gradual and continuous ones. Performance of each phase will be different depending on individual difference, but order of each phase will maintain the same.

### **2.2. Developmental theory of Vygotsky**

Infants are born with independent performance and assisted performance during their growing process. In Vygotsky's scaffolding theory, he points out that children are able to stimulate their learning potential during the process of learning through games playing if there are adults aside to offer proper resource and assistance. For children of kindergarten level, the media that can stimulate learning potential is through adults offering proper games and toys.

### **2.3. Temperament of Children**

The infants-temperament meter used in the present research takes this version as a revising standard. After evaluating grade of each dimension according to the infants-temperament meter, we are able to understand children's behavior reaction trend within each dimension. The present research will use the infants-temperament meter to evaluate children's performance, and divided children into different temperamental groups to discuss their preferences and durability toward toys.

### **2.4. Categorization of toys**

There are various kinds of toys, and so are categorizing standards. The present research will categorize toys according to Piaget's game theory of cognitive development.

The present research will utilize Piaget's game theory to divide toys into 5 categorizations and pick out the most typical toy of each categorization to be our experimental sample according to experts' opinion.

## **3. LITERATURE REVIEW**

### **3.1. Participants**

Participants are 23 students from advanced and intermediate class of kindergarten of Taoyuan County Ben-Gang Elementary School. Their age range is between 4 and 6 years old. Carers of the students, which are kindergarten teachers, are required to fill out questionnaire of children temperament.

### **3.2. Experimental sample**

We take Piaget's game theory as the basis of toys categorization and consult experts' opinion to choose the most typical toy of each categorization to be the experimental samples that are listed below:

1. Sensory action game: Game set that physical ability is integrated by senses, and hereafter it is defined as a physical toy.
2. Symbolic role-playing game: Game set of kitchen role-playing, and hereafter it is defined as a role-playing toy.
3. Structural construction game: Building blocks, and hereafter it is defined as a building block toy.
4. Fluid construction game: Wheat clay and clay tools, and hereafter they are defined as a clay toy
5. Number-symbol game: Number board and pokers, and hereafter they are defined as a number toy.



**Figure 1:** Experimental samples

### 3.3. Experimental environment

We decorate a kindergarten classroom as an experimental game zone and call it a “happy corner” in order to match up our activities which proceed in the corner. 5 experimental sample toys that represent Piaget’s game theory are placed in the corner, and toy amount of each categorization must be enough for participants. Jigsaw mats of different color are used to separate playing space of each game. Taping equipment are set in the classroom to record experiment process which is convenient for data collection and data analysis afterward.



**Figure 2:** Happy corner

### 3.4. Observation and recording

6 to 8 children are arranged to enter the experimental game zone- happy corner. Corner staying time for each group is around 40 minutes. Toys that are picked by children and their playing time length are recorded on experimental data sheet. Total experimental number of times is 23. Experimental data of 7 times for each participant are obtained.

The purpose of this phase is to utilize the decoration of happy corner to allow children to pick games and toys according to their preference. Through recording toy playing time as quantitative analyzing data, we discuss whether different kinds of toy will have different level of durability toward children.

## 4. DATA ANALYSIS

### 4.1. Analysis of participants

Through result of the questionnaires, we utilize cluster analysis to sort out children's temperament clusters. The sorting results are listed as below:

Extrovert type: 4 children, their activity level is higher than approach, their attention span is a little too short, and they are easy to be noticed

Unique type: 4 children, their activity level is high but short on attention span, and their persistence and adaptability are comparatively lower. Hyperactive children, schizophrenia, slow learners of learning and language are included in this type.

Serene type: 4 children, their activity level, approach, and intensity of mood are low, but their persistence is the highest. They are more focused to deal with their own business and rare to express their opinion or thought.

Ordinary type: 11 children, their adaptability is the highest among all clusters, but they perform ordinarily on the rest dimensions. The most children are in this type.

### 4.2. Durability analysis of experimental sample

The analysis of the present experiment is to individually measure playing time from the first to the seventh experiment. Our purpose is to understand whether differences of durability exist or not among toys through the toys choice every time from the beginning to the end of the experiment.

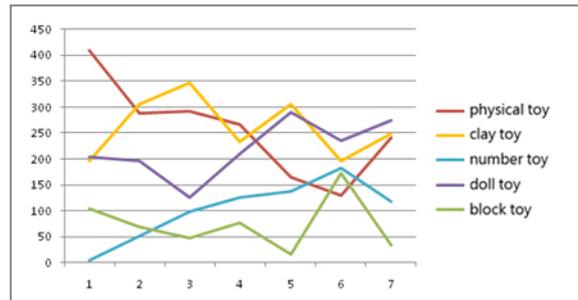


Figure 3: Durability analysis of experimental sample

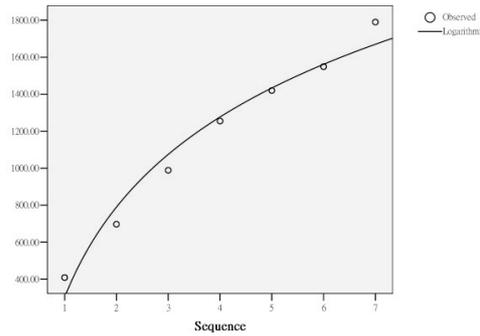
At first, the toy types children chose were not consistent. Playing time of physical toy is obviously higher than other toys. During mid-later phase of the experiment, children's choices of toys were more consistent which means that the phenomenon of obvious longer playing time of particular toy did not exist. As increasing of experimental number of times, the playing time of physical toy gradually decreased; On the contrary, no one picked number game at the beginning, but its playing time obviously increased during later phase of the experiment which anticipates that different level of durability do exist among different toys.

This phase also utilize regression curve estimation to draw out durability curves of 5 experimental toy samples during 7 times of experiment. Analysis purpose is to judge whether, as a whole, experimental samples have durability or not according to the trend of the regression curve.

#### 4.2.1. Physical toys

The curve regression mode of physical toys corresponding to the N time of experiment is a log curve. When the number of times of experiment gets higher, the time that children play with physical toys gets shorter. In other words, physical toys will be less and less attractive to children as the experiment is approaching toward its end. As for the result of the present research, physical

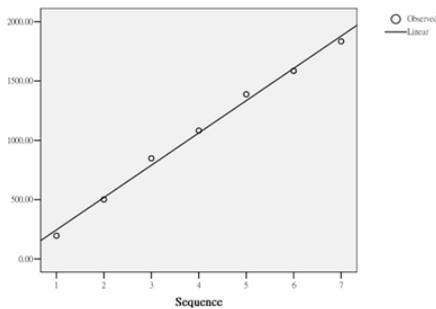
toys do not have durability.



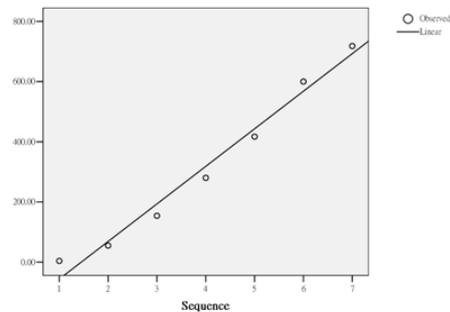
**Figure 4:** The curve regression mode of physical toys

#### 4.2.2. Clay toys and number toys

No matter during early or later phase, the time that children play with clay toys and number toys remains stable which means that these two toys have a certain level of durability.



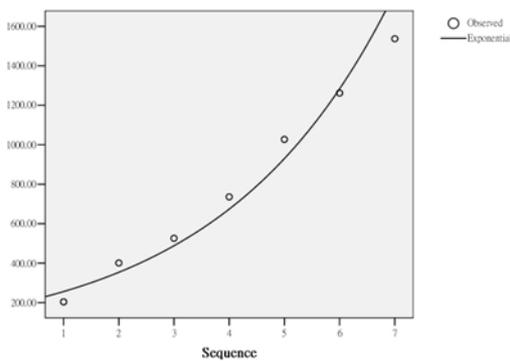
**Figure 5:** The curve mode of clay toys



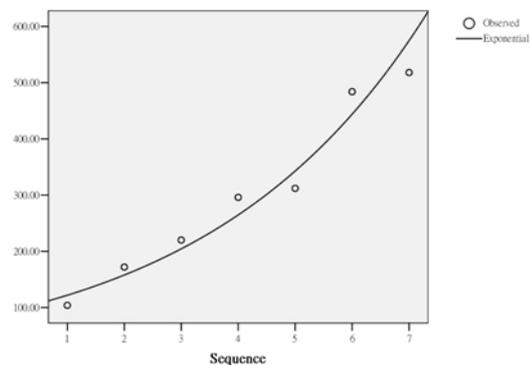
**Figure 6:** The curve mode of number toy

#### 4.2.3. Role-playing toys and building blocks toys

As for the time that children play with role-playing and building blocks toys, its increasing amount of later phase is larger than early phase that means that role-playing toys have the durability which can attract children continue to play with.



**Figure 7:** The curve mode of role-playing toys



**Figure 8:** The curve mode of building blocks toys

According to the analysis above, we can find out that among the 5 chosen toy samples, the playing time of building blocks and role-playing toys at the beginning is comparatively shorter but increasing during the later phase. However, the playing time of clay and number toys approximately remains the same. The above 4 toys

persistently attract children to keep playing with. Nevertheless, as for the physical toys, although it has the specialty to attract children and its playing time is the longest during the early phase of the experiment, however, as the number of times of experiment increases, its playing time becomes shorter and shorter which means that physical toys do not have durability among these experimental samples.

### 4.3. ANOVA analysis of temperament clusters toward toys playing time

According to the analysis result in the last chapter, physical toys are less durable to children in the present experiment. Thus, we will only discuss clay, number, role-playing, and building blocks toys. The present research utilizes one-way ANOVA to analyze playing time of children from different temperament clusters toward different toys:

Role-playing toy has significant p value for children from different temperament clusters ( $P=0.011<0.05$ ), and building blocks toy has near significant p value ( $P=0.056<0.1$ ). From Scheff's multiple comparison we can find out that the playing time of role-playing toys for children of unique type is obviously longer than children of ordinary type. Moreover, from the result of LSD multiple comparisons, the playing time of role-playing toys for children of unique type is obviously longer than other children. However, the playing time of building blocks toy for children of serene type is obviously longer than children of extrovert type.

**Table 1:** the analysis result of ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Clay toy	Between Groups	4663.705	3	1554.568	.329	.804
	Within Groups	89754.295	19	4723.910		
	Total	94418.000	22			
Number toy	Between Groups	7444.327	3	2481.442	1.333	.293
	Within Groups	35372.977	19	1861.736		
	Total	42817.304	22			
Doll toy	Between Groups	28558.120	3	9519.373	4.885	.011
	Within Groups	37024.750	19	1948.671		
	Total	65582.870	22			
Block toy	Between Groups	1778.705	3	592.902	3.014	.056
	Within Groups	3737.295	19	196.700		
	Total	5516.000	22			

From Scheff's multiple comparison we can find out that the playing time of role-playing toys for children of unique type is obviously longer than children of ordinary type. Moreover, from the result of LSD multiple comparisons, the playing time of role-playing toys for children of unique type is obviously longer than other children. However, the playing time of building blocks toy for children of serene type is obviously longer than children of extrovert type.

### 4.4. Characteristic extraction from toys

Through in-depth interview and observation on children's game playing, we could list some characteristics of toys, and sum up the characteristics by using Evaluation Grid Method. Upper level is the psychological receptivity of children playing games. Middle level is the description of gaming behavior. Lower level is the physical features of toy corresponding to play behavior.

There's not only one game characteristic on toy design. This study breaks the ordinary framework of single toy and extracts the game characteristics by using KJ method to sort the play behaviors (middle level) into seven game characteristics: (1) Activity of body movement (2) Various creating process (3) Playable created results (4) Application of the abstractive concept (5) Interaction with peer group member (6) Symbolic role-playing (7) Interesting facility.

#### 4.4.1. Activity of body movement

**Table 2:** Activity of body movement

Psychological receptivity	Play Behavior	Toys categorization
Push body to the limit The sense of equilibrium Restless Competition	It could make children move around Jump, creep, roll, shake, climbing high Sitting on it or lying on it Perform the regulated movement	Physical toys

#### 4.4.2. Various creating process

**Table 3:** Various creating process

Psychological receptivity	Play Behavior	Toys categorization
Imagination Feel free Variety	Create shapes Assembled parts at will could become some shape easily It could be assembled from many different directions	Building block toy
Process of transforming into solid With practical result Self-fulfillment	Copy what he looks at Something could be added detail Create some similar things Create any objects Need no rules	Clay toy

#### 4.4.3. Playable created results

**Table 4:** Playable created results

Psychological receptivity	Play Behavior	Toys categorization
Feel majestic Self-fulfillment Nervous<->Relaxing (cycled) Feel excited	It could become something large Sit on it The assembled item is playable It could be carried and movable The assembled item is playable	Building block toy
	It could become the slide or a seesaw Substitution of outdoor facilities	Physical toys

#### 4.4.4. Application of the abstractive concept

**Table 5:** Application of the abstractive concept

Psychological receptivity	Play Behavior	Toys categorization
Self-ability Performance Operability	It needs to use formula Showdown, partnership, sorting, sequence Match game It could be arranged in a row	Number toys

#### 4.4.5. Interaction with peer group member

**Table 6:** Interaction with peer group member

Psychological receptivity	Play Behavior	Toys categorization
Interaction Competition	Play with many people at the same time Competition for complete something well and quickly	Physical toys
	Play with many people at the same time Create stories	Role-playing toy
Interaction	Competition	Number toys

#### 4.4.6. Symbolic role-playing

**Table 7:** Symbolic role-playing

Psychological receptivity	Play Behavior	Toys categorization
Imitation behavior Sound effect Satisfy	Imitate adults Play roles in fairy tales Play animal roles Imitate the cooking behavior Play something forbidden in ordinary life	Role-playing toy

#### 4.4.7. Interesting tactility

**Table 8:** Interesting tactility

Psychological receptivity	Play Behavior	Toys categorization
Feeling Movement	Feel the tactility on clay It could be nip, rub or stab Love to cut clay It could be shaped by model Feel the tactility on clay	Clay toy
	Touch stimulation	Physical toys

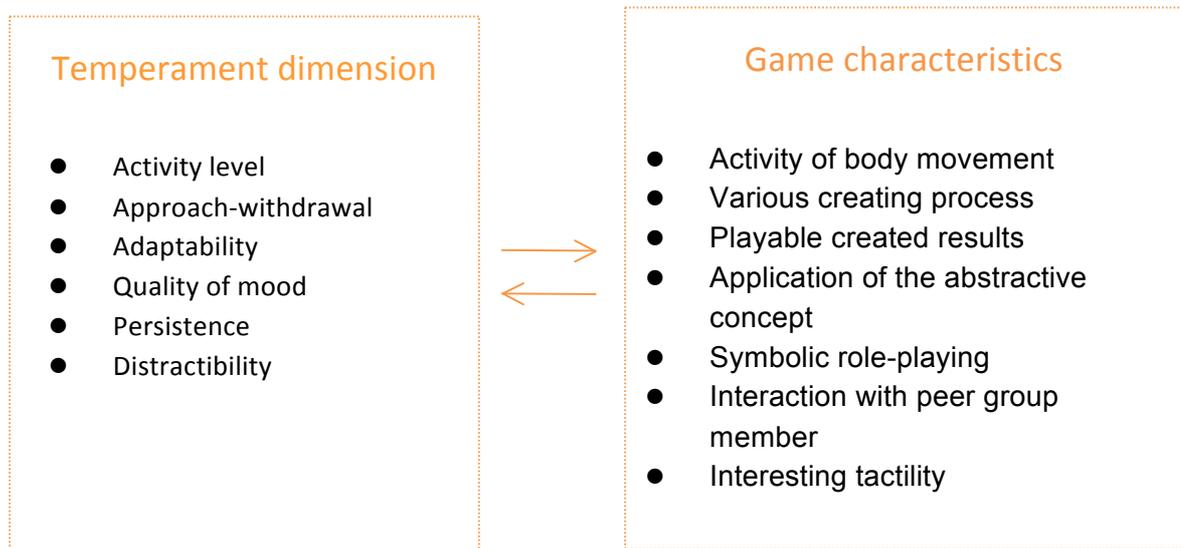
This study focus on children’s behavior and content in games and record the operating time when they play games with different characteristics, for example:

**Table 9:** Take Building block toys for example

Category of toys	Game behavior	Game characteristics
Building block toys	Create shapes	Various creating process
	Assembled parts at will could become some shape easily	
	It could be assembled from many different directions	
	It becomes fastness after assembling	Playable created results
	It could be assembled as a big object	
	It could become something large	
	Sit on it	
The assembled item is playable		

#### 4.5. Analysis of the playability relationship between game characteristics and children’s temperament

Based on the children’s scores in temperament dimension, we sort these scores into 3 groups (high, middle and low). ANOVA analysis would be used to study if children with different temperament dimension have corresponding operating time on different game characteristics.



**Figure 9:** Analysis of relationship between game characteristics and children's temperament

Research result shows as below:

It shows significant difference on children with different Persistence when they play game with these two characteristics: “Symbolic role-playing” & “Playable created results”

In the characteristic “Symbolic role-playing”, the mean value of low-persistence children is 131.00. It’s more than mean value of middle-persistence children (36.91),  $P=0.017 < 0.05$  (significant). It shows that “Symbolic role-playing” has more playability

for low-persistence children than middle-persistence children. In the characteristic “Playable created results”, the mean value of high-persistence children is 9.57. It’s more than mean value of middle-persistence children (0.00),  $P=0.007<0.05$  (significant). It shows that “Playable created results” has more playability for high-persistence children than middle-persistence children.

It shows significant difference on children with different Distractibility when they play game with the characteristic: “Symbolic role-playing”. The mean value of high-distractibility children is 135.50. It’s more than mean value of middle-distractibility children (39.6), and low-distractibility children (44.44),  $P=0.011<0.05$  (significant). It shows that “Symbolic role-playing” has more playability for high-distractibility children, than middle-distractibility children and low-distractibility children.

It shows a trend close to significant difference on children with different Approach-withdrawal when they play game with the characteristic: “Application of the abstractive concept”

In the characteristic “Application of the abstractive concept”, the mean value of middle approach-withdrawal children is 67.5. It’s more than mean value of low approach-withdrawal children (7.75),  $P=0.087$ ,  $0.05 < p < 0.1$  (close to significant). It shows that “Application of the abstractive concept” has more playability for middle approach-withdrawal children than low approach-withdrawal children.

It shows a trend close to significant difference on children with different Quality of mood when they play game with the characteristic: “Interaction with peer group member”

In the characteristic “Interaction with peer group member”, the mean value of children with middle quality of mood is 119.91. It’s more than mean value of children with high quality of mood (55.85),  $P= 0.078$ ,  $0.05 < P < 0.1$  (close to significant). It shows that “Interaction with peer group member” has more playability for children with middle quality of mood than children with high quality of mood.

There’s no significant difference on children with different Activity level or Adaptability when they playing games with varieties of characteristics.

## **5. CONCLUSION**

Role-playing toy is categorized as a “symbolic game plaything” in children development. This type of toy can facilitate children’s social behavior and improve individual ability to efficiently deal with problems of interpersonal relationship. Unique type children’s playing time of role-playing toy is obviously higher than ordinary type children, and Its possible reason is that the integration level among groups of unique type children is easily decreased by their physical and mental status factors. Due to lower level of socialization, children are more easily attracted by symbolic game plaything and fulfill their cognitive and personality developmental expectation and imagination through behaviors of role-playing. During the symbolic role-playing game, children’s preference of concrete toys is in inverse proportion to their socialization level which means that the younger or lower socialized the children are, the more they will be attracted by concrete toys.

Ways to play building blocks toys belongs to a experience of solving problems. From the perspective of cognitive motivation construction, as infants solve problems or have breakthrough, it means that the infants have obtained cognitive function of higher level. It requires higher attention when playing with building blocks toys, thus, it is easier to attract serene type children whose activity level is lower, attention span is shorter, and persistent level is higher.

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