Analysis on Preferred Element on Constructing Creative Play Space Design

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Abstract The purpose of this study is to investigate the various perspectives that children can provide by utilizing specific physical spaces for play, and to study how to effectively apply them to surrounding spaces and environments. AHP was used to analyze the preferred elements for effectively designing a play area. The main keywords were derived through case studies of various domestic and foreign play space designs, and each keyword was grouped and a keyword of a higher concept was derived. The results of the comparison of 14 keywords that were finally drawn using AHP for each element were used to derive the priority for the preferred elements. As a result, preference was derived in the order of "Openness", "Safety", and "Diversity" in the morphological properties of the play space, and "Adventure", "Five senses elements", "Visual elements" and "Interactivity" in the content properties of the play space.

Key Words : Creative Play, Play Space, Playground Design, AHP, Pairwise Comparison

요 약 본 연구는 어린이들의 창의적인 놀이 행위를 위해 특정한 물리적 공간을 활용하여 사용자가 제공할 수 있는 다양한 관점에 대해서 디자인하기 위한 필요 요소에 대해 조사하고, 주변 공간과 그 환경에 그 결과를 효과적으로 적용하는 방법을 연구한다. 놀이 공간을 효과적으로 디자인하기 위한 선호 요소를 분석하기 위해서 AHP 분석 방법을 활용하였다. 다양한 국내외의 놀이 공간 디자인의 사례 조사를 통해서 주요한 키워드를 도출하였으며, 각 키워드를 그룹핑하고 상위 개념의 키워드를 도출하였다. 이를 통해서 최종 도출된 14가지의 키워드를 AHP를 활용하여 각 요소별 쌍대 비교한 결과를 통해서 놀이 공간을 디자인하기 위한 선호 요소에 대한 우선 순위를 도출하였다. 분석 결과 놀이 공간의 형태적 속성에서는 "개방성", "안전성", "다양성" 등의 순서로 선호도가 도출되었으며, 놀이 공간의 콘텐츠적 속성에서는 "모험성", "오감 요소", "시각 요소", "상호작용성" 등의 순서로 선호도가 도출되었다.

주제어 : 창의적 놀이, 놀이 공간, 놀이터 디자인, AHP, 쌍대비교

1. Introduction

1.1 Background and Purpose of the Research

The purpose of this study is to investigate the various perspectives that children can provide by utilizing specific physical spaces for play, and to study how to effectively apply them to surrounding spaces and environments. The play area is directly related to the concept of a playground for children, but through various acts of play, children can be provided with various functions including education and so on. The play space for children is gradually changing and developing over time. In the past, the spaces and alleys formed around adults could be considered as children's play spaces, but in various modernized cities, play spaces for systematically planned children are provided in various forms[1].

These play spaces can activate children's free and active body functions, and with active interaction with the surrounding natural environment, it also can provide diverse and rich sensory experiences[2]. This research will investigate the importance of the each element for designing and constructing the play space for children, and will create the basis for the design guideline in constructing the creative play space design.

1.2 Boundary and Method of the Research

In this research AHP(Analytic Hierarchy Process) which belongs to the multi-criteria decision making methods(MCDM) was used to induce the preferred design elements for effectively designing the space for a play[3]. The scope of the research for case study was limited to the case of domestic and foreign play space design. Main keywords were derived through investigation and analysis of each case, and each keyword was grouped and a higher-level keyword was formed. Through this process, the 14 derived keywords were compared by using AHP for each element. And the priority of the preferred elements for designing the play space was derived.

2. Concepts and Characteristics of the Creative Play Space

2.1 Concepts of Creative Play Space

As there were not enough space for people to relax with the rapid increase in urbanization and the destruction of green areas for building the new settlements, the need of the play space for children became more important. Children are weak on sensibility and not clearly expressing their desire as they need to act differently on each phases of the play. And playgrounds became the play where children with all ages can creatively and commonly spend their times[4].

Play is very essential to the healthy development of children as it develops physical, social and cognitive capabilities[5]. And the play space can be regarded as the starting point for infants and children to develop creative thinking through various experiences. It also can become a place to enhance social experiences and awareness for growth where various users can spend time and work together.[6] Creating inspiring play spaces which please, challenge, and also satisfy children requires knowledge of play, technical skill, understanding and imagination[7].

Also the physical environments including building, structure, land, outdoor play space, internal/external facilities, teaching material, and nursery will provide the comparably bigger influence in developing intelligence and physical capability of infants and children. According to the results of various studies, the physical environment, the composition and arrangement of the space, and the amount and use of learning

materials will influence the effect of the early childhood education[8].

2.2 Analysis on Creative Play Space Cases and Keyword Derivation

Through the collection and analysis of domestic and foreign creative play space cases, a total of 215 keywords, excluding duplicate keywords, were derived and classified into similar attributes.

Table 1. Analysis on Creative Play Space Cases

Image/Name	Keywords
The Pod Playground	Providing various communication methods with the surrounding environment Consists of various rides for horizontal and vertical dynamic movement
	Open space, secure visibility, no walls, various heights, comfortable environment, nature-friendly, non-plastic equipment, continuous management, space continuity
Magical Bridge Playground	Various devices are arranged by utilizing the difference in height of the space Repeated concentration and distribution of play equipment in a large space
	Anyone can use, intuitive, clarity, universal design, communication, community organization, without barriers, collaboration+communication, visual elements, no restrictions, minimal intervention
Zorlu Center	It is divided into various areas, and each area has a different appearance. Proper blend of various colors, wood, metal, and natural materials
	Simple form, equality, unity, anyone, self-directed, secured vision, wallless, clean rides, learning opportunities, learning space
Clemyjontri Park Playground	Pursuing a dynamic look by utilizing primary colors Separate areas by using color on the floor Utilizing the vast site, it looks like a playground and a playground combined
	Diversity of colors, visual elements, various materials, use of surrounding terrain, storytelling, large space, boundary between architecture and playground, nature-friendly, learning space

As a result, the keyword was categorized into a total of 15 top groups, including "Safety", "Diversity", "Irregularity", "Simplicity", "Eco-friendliness", "Openness", "Closedness", "Flexibility", "Universality", "Education",

"Interactivity", "Adventure", "Visual elements", "Five sense elements", and "Subjectivity".

Table 2. Keyword Grouping

Group	Keywords
Safety	Safe to free activity, Durable/ Non-irritating material, Handrail/Not too high, Hygiene, Children can be seen by the parents, Comfort/Cozy
Diversity	Diversification of rides, Various types of entrance, Combination of two or more elements, Various programs
Irregularity	Unusual, Atypical form, Unpredictable, Distorted and deformed, Smooth curve
Simplicity	Wasteless, Fundamental, Geometric, Deconstructionism, Modernism, Futuristic, Composition, Shapes
Eco-Friendliness	Harmonious with the environment, Nature experience, Nature friendly materials, Nature experience in the city, Recycled rides, Log, Garden, Cave
Openness	Unobstructed, Space to run around 360 degree, Free Circulation, Spacious play area with many people, Unlimited, Parental vision
Closedness	Space Separation, Hidden space, Ajit, Cave, New world, Immersive, Indoor playground, Age division, Unaffected by the weather
Flexibility	Flexible/Wired/Fluid, Four seasons, Not setting a specific purpose, Playground on a small scale, Breaking stereotypes, Changing space purpose, Playing out of fashion
Universality	Space for multiple community, Various ages, Rides designed for the disabled, Designed for different height, Eye level, Undifferentiated space
Education	Creating play for oneself, Thinking upside down, Making it possible to infer, Questioning everything, Transformation, Instrument using scientific elements
Interactivity	Collaboration, Communication, Doodle, Operation, Rides
Adventure	Spacing inside the rides, Stepping stones for each mechanism, Diverse experience elements, Net, hot air balloon, Hill, Maze, Mechanisms(slides, swings), Conquest, Novelty, Fun, Fluid relations of structures, Active amenities, Little dangerous
Visual	Meaning and effect of color, Visual materials(characters, and etc.), Colorful, Creative color, Brilliant color, Saturated, Bright colors
Five Senses	Hearing(singing), Exciting music, Acoustic play, Incense, Textured expression, Various touch play, Muscle use
Subjectivity	Imagination, Unsubstantial, Fantasy, Concept, Playground with story, Transparency, Application of objects, Fairy tale, Concentric, Pure, Tradition, Culture, Course, Travel, Extraordinary physical experience

In addition, a total of 15 keyword groups were largely classified into two attributes, "Morphological properties of creative play space" and the "Content properties of creative play

space". Keywords and the meaning of the secondary layer for each attribute are as follows.

1) Morphological properties of creative play space
- Safety: It is equipped with a safe environment for various activities, and the guardian can easily monitor children's activities.
- Diversity: Play spaces require play equipment that allows children to play in a variety of ways.
- Irregularity: Naturally, chances can be increased through a combination of unexpected elements rather than expected elements.
- Simplicity: Each ride needs to be designed to be as visual as possible.
- Eco-friendliness: It is possible to directly experience natural elements through harmony with the surrounding environment, and it is necessary to make play equipment using recycled materials.
- Openness: It monitors user movement in various directions, and the field of view must be open for easy viewing by guardians.
- Closedness: Through the division of each space, each play element needs to be closed, and it is necessary to provide a space for children to hide.
- Flexibility: It can be useful in a variety of environments that break prejudice, and requires elements of play that can be enjoyed continuously, regardless of weather, season, and time.

2) Content properties of creative play space
- Universal: It should provide rides and structures that can include people with disabilities and users of different ages.
- Education: Users should be able to learn new things while having fun and solving problems while enjoying play.
- Interactivity: Users should be able to use rides while cooperating and communicating with each other.
- Adventure: The structure should provide a variety of experiences, and sometimes it needs to provide a play experience in a harsh environment.
- Visual: It is necessary to express the effect of color and visual materials using bright, saturated, and various colors.
- Five senses: It is necessary to construct content that can stimulate the user's five senses.
- Subjectivity: Each ride and structure need to be planned and expressed on a specific subject.

3. Analysis of Play Space Design Preference Factors Using AHP

3.1 AHP

AHP, developed by mathematician Thomas Saaty in the 1970's, is a method for assessing and prioritizing options which is widely used for complex and multi-criteria decision-making.[9] In this research AHP was used to grasp the important factors between the derived keywords, and this is the part of "Analytic Hierachy Process", which compares each of the factors classified by each layer in order to accurately derive the importance of each factor. In addition, it is a technique that comprehensively judges the results and identifies each priority.[10] AHP is a mathematical technique or tool for solving problems that became popular amongst management personnel in the late 1990's and early 2000's.[11]

AHP supports decision-making to capture the evaluator's knowledge, experience and intuition, and reflects both qualitative and quantitative aspects of multiple factors. As a result, this enables logically consistent research, and also supports the right decision-making process

based on the related influence between the elements by structuring the components of the problem.[12]

3.2 Keyword Derivation of Play Space Design Using AHP

Keywords derived based on case studies were largely classified into two categories(criteria), which were classified into primary and secondary(sub-criteria). In addition to this, each keyword of the secondary layer is briefly expressed as Table 3.

Table 3. Evaluation Criteria for Design element

Criteria	Sub-criteria	
Morphological Properties of Creative Play Space	Safety	SF
	Diversity	DV
	Irregularity	IR
	Simplicity	SP
	Eco-Friendliness	EF
	Openness	OP
	Closedness	CL
	Flexibility	FL
Content Properties of Creative Play Space	Universality	UV
	Education	ED
	Interactivity	IA
	Adventure	AV
	Visual	VS
	Five Senses	FS
	Subjectivity	SB

Also, based on the evaluation criteria as shown on Table 4, each keyword(factor) is compared using qualitative scale from 1(Equal importance) to 5(Absolute importance).

Table 4. Evaluation Criteria for Design element

Scale	Qualitative Scale	
1	Equal Importance	Two elements have the same importance
2	Slight Importance	One element is slightly more important than the other
3	Strong Importance	One element is more important than the other
4	Demonstrated Importance	One element is very important to another
5	Absolute Importance	One element is absolutely important compared to the other

3.3 AHP Analysis on Sub-criteria

The content of the AHP questionnaire includes expertise in related fields, and was conducted for 10 experts in the related design field because the questionnaire is comparably difficult for the general public to perform. The results for the questionnaire are shown in Table 5 and Table 6.

Table 5. Pairwise Comparison in Morphological Properties of Creative Play Space

A	A>B				A=B	A<B				B
	5	4	3	2	1	2	3	4	5	
SF	2	1	2		1	1	1	1	1	DI
SF	1	2	2	1		1	3			IR
SF	2	1	3	1			1	2		SP
SF		2	3	1	2		2			EF
SF			3	2	1		1	2	1	OP
SF	1	3	3	2			1			CL
SF	1	1	1	1		2	1	2	1	FL
DV			2	1	6		1			IR
DV		2	5		1		1	1		SP
DV		2	1	2	2		2	1		EF
DV		1	1	2	1		2	2	1	OP
DV		2	4	1	2		1			CL
DV		1	1	2	3	1		2		FL
IR	1	1		2	3	1	1		1	SP
IR		1	1	1	1	3	2		1	EF
IR			2	3	1	1	2	1		OP
IR		1	1	3	3	2				CL
IR			2	1	2		2	1	2	FL
SP			1		1		6	2		Eco
SP			1		2	2	3	2		OP
SP		2	2	2	2	1	1			CL
SP			1	2	2	1	2	2		FL
EF		1		1	5	1	1	1		EF
EF	1	2	3	1		1	2			CL
EF		1	3		2	1	2	1		FL
OP	2	3	2	1	1		1			EF
OP			2	2	4	2				OP
CL			1		1	4	1	2	1	CL

Table 6. Pairwise Comparison in Content Properties of Creative Play Space

A	A>B				A=B	A<B				B
	5	4	3	2	1	2	3	4	5	
UV		1	2	1		1	3	1	1	ED

UV			1		3	1	3	2		IA
UV			2			2	1	3	2	AV
UV			2	1	2	3	1	1		VS
UV		1	1		3	2			3	FS
UV	1				4	1	3		1	SB
ED		1	1		3	2	1	1	1	IA
ED			1	1	1		4	2	1	AV
ED			2	1	3		3		1	VS
ED				1	2	1	2	2	2	FS
ED				2	5		2	1		SB
IA			2		4	1	1	1	1	AV
IA			2	2	3		2		1	SB
IA				1	4	2	1	1	1	FS
IA		2	1	2	2	2	1			SB
AV			5	2	1	1	1			VS
AV		1	4		3	1	1			FS
AV	1	1	2		4	1	1			SB
VS		1	2		1	4	1	1		FS
VS		1	3	1	2	1	2			SB
FS		1	1	3	3		1	1		SB

The results of relative comparison of evaluation criteria in "Morphological properties of creative paly space" and "Content properties of creative play space" are shown in Table 7 and Table 8.

Table 7. Results of Relative Comparison of Evaluation Criteria in Morphological Properties of Creative Play Space

	SF	DV	IR	SP	EF	OP	CL	FL
SF	1.000	1.429	1.714	1.152	1.700	0.733	1.417	1.286
VR	0.700	1.000	1.478	1.364	1.205	0.786	2.167	1.059
IR	0.583	0.677	1.000	1.261	1.217	0.497	2.143	0.656
SP	0.868	0.733	0.793	1.000	0.730	0.700	2.000	0.758
EF	0.588	0.830	0.822	1.370	1.000	1.008	1.757	1.333
OP	1.364	1.272	2.012	1.429	0.992	1.000	2.356	1.875
CL	0.706	0.461	0.467	0.500	0.569	0.424	1.000	0.818
FL	0.778	0.944	1.524	1.319	0.750	0.533	1.222	1.000

	SF	DV	IR	SP	EF	OP	CL	FL
Weight	0.154	0.138	0.11	0.107	0.126	0.177	0.072	0.117
Consistency Index				0.0258				

Reliability was verified based on the responses to the questionnaire, and a consistency ratio(CR) was calculated. According to Saaty, who developed AHP, when the ratio of consistency is less than 0.1, pairwise comparisons reasonably

Table 8. Results of Relative Comparison of Evaluation Criteria in Content Properties of Creative Play Space

	UN	ED	IA	AV	VS	FS	SB
UV	1.000	1.071	0.621	0.952	1.167	0.960	0.900
ED	0.934	1.000	0.960	0.649	0.812	0.375	0.662
IA	1.610	1.042	1.000	0.778	0.857	0.485	2.250
AV	1.050	1.541	1.285	1.000	1.714	2.083	1.154
VS	0.857	1.232	1.167	0.583	1.000	1.658	1.607
FS	1.042	2.667	2.062	0.480	0.603	1.000	1.154
SB	1.111	1.511	0.444	0.867	0.622	0.867	1.000

	UN	ED	IA	AV	VS	FS	SB
Weight	0.128	0.101	0.146	0.191	0.154	0.162	0.119
Consistency Index				0.0644			

include consistency.[13] As a result of analysis, each consistency index was derived as "0.0258" and "0.0644", and the reliability test showed reasonable consistency.

As a result of the AHP analysis, the preference of "Openness", "Safety", "Diversity", "Eco−friendliness", "Diversity", "Irregularity", "Simplicity", and "Closedness" was high in the order of "Morphological properties of the creative play space". In the "Content properties of the creative play space", the preference was high in the order of "Adventure", "Five senses", "Visual", "Interactivity", "Universality", and "Education".

Table 9. Evaluation Criteria for Design element

Criteria	Sub−criteria		
Morphological Properties of Play Space	Safety	0.154	2
	Diversity	0.138	3
	Irregularity	0.110	6
	Simplicity	0.107	7
	Eco−Friendliness	0.126	4
	Openness	0.177	1
	Closedness	0.072	8
	Flexibility	0.117	5
Content Attributes of Play Space	Universality	0.128	5
	Education	0.101	6
	Interactivity	0.146	4
	Adventure	0.191	1
	Visual	0.154	3
	Five Senses	0.162	2
	Subjectivity	0.119	6

In addition, the results of this study are considered to be as design guidelines based on the priority of design in order to proceed with creative play space design in the future.

4. Conclusion

The purpose of the research is to investigate the various perspectives that children can provide by utilizing specific physical spaces for play, and to study how to effectively apply the results to the surrounding spaces and environments. The research used AHP analysis method to analyze the preferred elements for effectively designing a play area and the main keywords were derived through case studies of various domestic and foreign play space designs. Also, each keyword was grouped and a keyword of a higher concept was derived.

The results of the comparison of 14 keywords that were finally drawn using AHP for each element were used to derive the priority for the preferred elements for designing the play area. As a result of analysis, preference was derived in the order of "Openness", "Safety", and "Diversity" in the morphological properties of the play space, and "Adventure", "Five senses elements", and "Visual elements" in the content properties of the play space.

It is very important to improve "creativity" and "problem solving" with the advent of the 4th industrial revolution era, and this actively needs to be applied to children's creative play activities.[14] Also, playing is a way to provide experience and knowledge to children, and it plays very important role on providing diverse experience for improving physical and mental capability of children.[15]

This research, however, suggested the preferences for designing the creative play ground for children, in the future, the further research will suggest the successful design examples based on the preferences of design element derived from the research.

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