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Analyzing kindergarten's Interior Spaces for Enhancing Children's Creativity Erbil City as a Case Study

Husein A. Husein ^a, Rawaz A. Shareef ^{b*}

^a Department of Architecture, College of Engineering, University of Salahaddin, Erbil, Iraq

^b Department of Architecture, College of Engineering, University of Salahaddin, Erbil, Iraq

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ABSTRACT

The promotion and activation of creativity in children is extremely valuable due to their age growth. All types of environments, such as geographical, social, physical, and cultural environments, have a huge impact on children's development. Many studies have discussed the role of the environment in general in the creativity and development of children. However, the effect of the physical environment specifically seems to be disregarded. Nowadays children spend a lot of their time in kindergarten, thus the physical environment of kindergarten affects the children's development and creativity. It is noticed that at the kindergartens of Erbil city, the majority of the factors that contribute to creativity have been disregarded. The kindergartens are more of an academic institution than a place where children can be entertained or encouraged to be creative. In this study, qualitative and quantitative methodologies are applied to analyze the interior spaces of kindergartens in Erbil city. This paper seeks to create a content environment that encourages children to improve their abilities and potential skills. The found results prove that the physical environment factors are effective and significant in increasing children's creativity in kindergartens.

1.Introduction

Creativity is the capability to solve problems quickly and effectively through unique, imaginative, original, and suitable solutions (13). Early on, innovators like Thomas Edison and Charles Kettering learnt how to solve problems creatively and use their prior knowledge to transform creativity into innovation. People with these creative traits should be encouraged to educate others how to accomplish this in the future (16). Since 1950, psychologists have discovered that creativity and intelligence are not the same, as a result, they have gradually conducted substantial research in this field (20). A combination of cognitive, emotional, envi-

ronmental, and motivational factors affects people's capacity for creativity (4). In addition to the significance of parents' roles, the environment in which children engage in their activities in the golden years of their life is a significant factor in their development (18).

Early educational experiences that incorporate imaginative and creative thinking establish a good foundation on which children can create their future worlds (12). This will happen through incorporating goals into the preschool facility designs that promote the child's ability to explore himself and his environment. The design should promote the child's inventiveness while enabling him to engage in critical thought and social interaction with

* Corresponding author. Rawaz A. Shareef ; rawazabdullah2311@gmail.com ; +9647504974621

classmates to improve his social skills. These objectives can be achieved by developing a design that offers a healthy indoor environment and by utilizing design components that inspire kids to engage in different activities (2). This study seeks to create a content environment that encourages children to improve their abilities and potential skills through determining a relationship between a kindergarten's physical environment and children's creativity. There is not enough research on kindergartens in Erbil city in general and more specifically on how to foster creativity in the kindergartens. Conducting such studies may contribute towards change in kindergarten interior spaces and hopefully inspire children's creativity.

1.1. Childhood and children

A child is a person who is under the age of eighteen (14). Because each period is a continuum with individual distinctions in starting and ending, there are numerous definitions of periods in a child's development (11). This research has concentrated on the preschool age group for the purposes of this study. Children are untapped reservoirs of talent and potential, not fully developed abilities. Children have a lot of imagination. With just a little help and guidance, they can help it grow and bloom (1). Childhood is when most of a person's abilities are first developed. In their childhood, all people have some creative abilities. However, being in the wrong environment, disregarding these skills, and failing to strengthen them all impede their growth and appearance (6).

1.2. Interior spaces

Indoor and outdoor areas are separated in space. Ching (1992) defined an indoor space as one that is constrained by large objects (for example, walls, floors, ceilings, partitions, and so on). In contrast, the outdoors is an open area free of any structures, serves as a gathering place for people, and has social functions (25) Since this study is about interior spaces, consideration will be given to kindergarten interior space design. The characteristics of space and how it is used have a significant impact on personality. It is crucial for children to have more specialized space as they grow since it promotes their intellectual and physical development (9). The word "creative space" encompasses anything from a single piece of furniture to room interior design and layout, as well as architectural structures and

location within a neighborhood or metropolis (23) Figure 1.

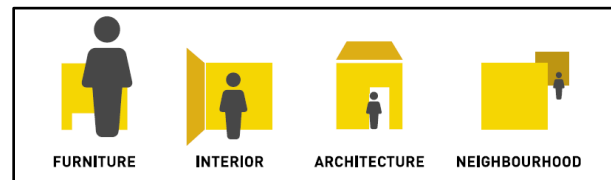


Figure 1. The system of creative spaces (Thoring et al., 2018)

1.3. Creativity in kindergarten

According to studies, creative capacity is developed throughout childhood, with the ideal time to develop creativity being between the ages of 2 and 10 (10). Based on different studies on children's creativity, our study pinpointed kindergarten as the most suitable environment in which children's creativity can flourish.

1.4. Creativity, kindergarten and architecture

The environments that architecture creates play an important role in training individuals. Because of their sensitivity and influence, this role is significantly greater in the design of spaces relevant to children (1). Mark Rosenzweig of the University of California discovered in 1960 that physical, social, and mental engagement can safeguard memory and attentiveness while also stimulating brain growth. Mice in normal cages were compared to mice in enriched enclosures with ladders, toys and wheels. Mice raised in an "enriched" environment, which includes other mice and a range of stimulating toys, gained more dendritic development and performed better than mice in normal cages Figure 2. Thus, architecture must stimulate people in an enriched environment in order to foster stimulation and thoughts in creative thinking. It not only promotes mental, social, and physical stimulation, but it also acts as a positive regulator of neuronal growth (5)

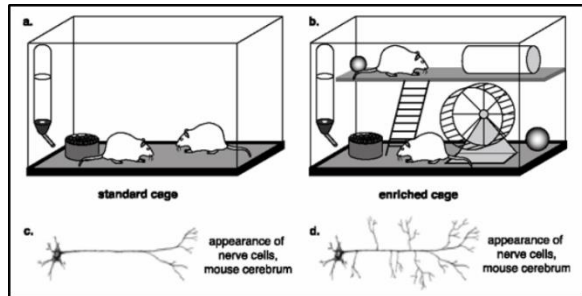


Figure 2. Mice raised in a poor environment (a) show less dendrite development (c) than do mice raised in an improved environment (b, d). (Babatugon, 2014)

1.5. Background

creative spaces should be established so that children at various stages of development can choose and access a variety of environments based on their specific needs. Natural, private, sociable, flexible, playful and sensual stimulating environments are among the creative environments (21). When building kindergartens, a number of factors and components must be considered, each of these components should be designed to meet the needs of children while also encouraging their imagination and creativity (7). Preschoolers have a lot of imagination; they enjoy play-acting to be animals and acting out inventive ideas about them. The significant relationship between creativity variables (imagination, curiosity and cooperative play) and architectural factors (flexibility of functions and stimulant of natural elements) caused proposing many design patterns of kindergarten by researchers (20). This connection has been investigated in a study that looked into the IEQ (Indoor Environment Quality) of public kindergartens in Jordan–AL Salt–and compared the results to foreign kindergartens. According to the findings of the study, three headings can be used as a guideline for constructing a proper kindergarten for the improvement and development of children which are (environment organization, material selection, and detail solution). The study prioritized the characteristics of safety and flexibility among the physical factors that promote children's creativity (3).

The importance of playing and Play areas as the most effective aspects in developing children's creativity has shown in a study by Suk Han, using the AHP technique in the study, the desired elements of the creative play environment were determined to be: Openness, Safety, and Diversity, Adventure, Five Senses Elements, Visual Elements, and Interactivity

(22). On the other hand, the role of color as another effective factor in promoting children's creativity in kindergartens is very significant, also there are some important design ideas such as cave design space and wall design for painting by children, since they fulfill children's everyday games and make them become more productive and imaginative (24). Correspondingly, furniture and materials in the physical space are the effective factors in the interior spaces of kindergartens (17). Finally, the current kindergartens must be upgraded to meet modern standards of comfort. This rehabilitation effort is also an excellent opportunity to rebuild kindergartens in order to improve the buildings' ambient value (15).

1.6. Research variables:

After analyzing the previous related studies, it became obvious that there are the factors that have an effective role in promoting children's creativity in kindergartens. Each study has its own set of variables and criteria. Variables of this research were summarized depending on the previous studies which are two types of variables dependent and independent variables.

The creativity variables (Dependent Variables) are: 1-Imagination, 2-Curiosity 3- play, and the physical environment variables (Independent Variables) 1-Variety 2-Flexibility of performance, 3-Diversity, 4-Design of internal spaces 5-Complexity 6-Safety and security 7-Materials 8-Lighting and colors; 9-Visual elements 10-Natural elements 11-Privacy.

2. Materials and methods:

In this study the qualitative and quantitative methodologies are applied to analyze the interior spaces of kindergartens in Erbil city. The statistical population of this study includes all kindergarten children in Erbil city. Due to their specific perceptual and verbal characteristics, the mentioned children were studied through attitude measurement of the teachers of kindergartens and the parents of the children. Hence 260 teachers of 24 kindergartens were selected through the random cluster sampling method to measure their attitude. And 300 parents were selected through the random sampling to measure their responses.

2.1. Case study

The case study of this research is twenty-four kindergartens in Erbil city they are chosen through the random cluster sampling. So, the kindergartens (K1 to K24) were selected from four different zones of Erbil city. The zones are identified as follows: (A, B, C, D) Figure 3. The construction year of (K1 to K24) is between the years of 1976 and 2020. Their areas are between 1000 m² and 4000 m². They are generally consisting of the class rooms (both study rooms and entertainment rooms), playground areas (Indoor and outdoor), Cafeteria, Staff rooms, nurse room, store, bath rooms. The number of teachers of (K1 To K24) ranges from 3 to 20, and the number of children of (K1 to K24) is between 21 and 290.

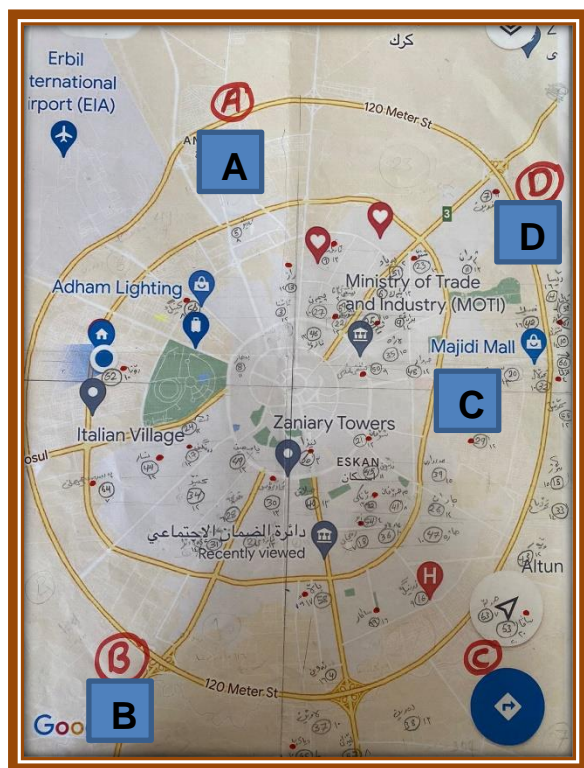


Figure 3: Determining case study of research on Erbil master plan (Author)

● Selected case study

The total number of kindergarten teachers in Erbil city is 738. According to SPSS software, 253 teachers were selected as respondents.

$$\begin{aligned} & \text{No. of teachers in each zone} \\ & \div \text{No. of teachers in EBL city} \times 253 \\ & = \text{No. of selected teachers in each zone} \end{aligned}$$

For example:

$$61 \div 738 \times 253 = 21 \text{ (Number of teachers in zone A)}$$

And the same is true for the other three zones (B, C, and D). The table below shows the process of selecting the teachers (respondents) for the research.

Table 1. Selecting the number of teachers as respondents in the study (Author)

Zones	Number of kindergartens	No. of teachers	No. of selected teachers (respondents)
A	6	61	21
B	10	116	40
C	27	309	106
D	23	252	86
Total	66	738	253

Because Zone A accommodates only 3 kindergartens and, according to the above table, the number of selected teachers in this zone is 21. However, in order to have different cases and more accurate results, the current research studied each of 3 kindergartens, so the number of respondents in this zone became 28 teachers. Thus, 260 teachers from 24 kindergartens were selected to measure their attitude, and 300 parents were selected through random sampling to measure their responses.

2.2. Measurement tools:

The questionnaire to measure the attitude of the teachers designed based on the following eleven factors: variety, flexibility of performance, diversity, design of internal spaces, complexity, safety and security, materials, lighting and colors, visual elements, natural elements, privacy. The questionnaire consists of 31 questions based on Likert scale. The questions consider the relationship between these eleven variables of physical environment and the creativity variables. The parent's questionnaire also is about the same variables but based on the multiple-choice questionnaire. The other tool that used in this research is checklist. Which was designed based on the same variables that used in questionnaires, it was done through the observation and photo shooting of the twenty- four kindergartens that studied in this research.

3. Results and discussion:

The statistical analysis of the questionnaire divided in to six-parts: the first part included the descriptive analysis personal information of the respondents. The second part of the analysis included Reliability test as the most often used indicator of internal consistency. The third part included One Way ANOVA analysis in order to test the difference of each factors according to the study zone. The fourth part included Person correlation Coefficient which is a measure of a strength of the liner relation between two or more variables (each independent variable will be correlated to a dependent variable). The fifth part involved Simple liner regression Analysis to test the effect of independent (physical environment) on a dependent variable (creativity). The last part involved Factor analysis to show variability and differences among correlated factors and to extracted maximum common variables and put them into a new group that can be used for further analysis. The following table shows the number of teachers as respondents in each zone and personal information of them Table 2.

Table 2. Personal information

personal information	Count	%
Zone	A	28 10.8%
	B	40 15.4%
	C	106 40.8%
	D	86 33%
Education	Diploma	141 54.2%
	Bachelor	109 41.9%
	High school	10 3.8%
Year/Experience	Less than 10 years	148 56.9%
	More than 10 years	112 43.1%

The analysis of personal information of the respondents showed that 28 (10.8%) of the respondents are in zone A, 40 (15.4%) of them are in zone B, whereas 106 (40.8%) of them are in zone C and 86 (33%) of them are in zone D. 141 (54.2%) of the respondents have diploma degree and 109 (41.9%) of the respondent holding the Bachelor degree, while only 10 (3.8%) of the respondents have the level of high school. The result of this analysis also indicates that 112 of 260 teachers have over 10 years of teaching experiences.

in this study the reliability test is used to indicate the internal consistency. The following table illustrates that the questionnaire is reliable Table 3.

Table 3. Reliability test

Reliability Statistics		
Cronbach's Alpha	No. of Items	Decision
0.846	31	Reliable

Regarding the analysis of variance (ANOVA) which was used in order to test the difference of each factors according to the study zone. Also, LSD (Least Significant Difference) which is the method to multiple comparison for physical environment factors used to compare between two zones in order to indicate the difference between them. The tables below show the result of one-way ANOVA test in this study table 4, table 5, table 6.

Table 4. ANOVA test to Comparer means for Physical Environment

	Zone	N	Mean	Std. Deviation	F-test	p-value
Design of internal spaces	A	28	4.20	0.534	1.264	0.287
	B	40	4.48	0.456		
	C	106	4.26	0.874		
	D	86	4.32	0.459		
	Total	260	4.31	0.668		
Flexibility of performance	A	28	3.68	1.063	1.867	0.136
	B	40	3.94	0.690		
	C	106	3.61	0.827		
	D	86	3.57	0.911		
	Total	260	3.65	0.869		
Natural Elements	A	28	4.77	2.594	1.963	0.120
	B	40	4.84	0.286		
	C	106	4.51	0.490		
	D	86	4.78	0.309		
	Total	260	4.68	0.928		
Color and lighting	A	28	4.24	0.714	7.424	0.000**
	B	40	4.64	0.423		
	C	106	4.23	0.710		
	D	86	4.55	0.476		
	Total	260	4.40	0.624		
Safety and security	A	28	4.30	0.657	3.282	0.021*
	B	40	4.85	0.258		
	C	106	4.59	1.134		
	D	86	4.74	0.347		
	Total	260	4.65	0.800		
Visual elements	A	28	4.16	0.695	3.282	0.002**
	B	40	4.54	0.524		
	C	106	4.21	0.693		
	D	86	4.49	0.553		
	Total	260	4.35	0.640		
Diversity	A	28	4.41	0.782	5.484	0.001**
	B	40	4.79	0.318		
	C	106	4.50	0.621		
	D	86	4.74	0.484		
	Total	260	4.62	0.576		
Complexity	A	28	4.13	0.857	3.789	0.011
	B	40	4.38	0.528		
	C	106	3.99	0.914		
	D	86	4.31	0.674		
	Total	260	4.17	0.796		
Privacy	A	28	4.00	1.089	2.565	0.055
	B	40	3.73	0.905		
	C	106	3.92	0.902		
	D	86	4.17	0.814		
	Total	260	3.98	0.905		
Variety	A	28	3.93	1.184	4.916	0.002**
	B	40	4.58	0.549		

	C	106	4.35	0.731		
	D	86	4.48	0.646		
	Total	260	4.38	0.759		
Material	A	28	4.25	0.967	0.930	0.427
	B	40	4.48	0.716		
	C	106	4.20	0.999		
	D	86	4.29	0.824		
	Total	260	4.28	0.901		
**Significant at level (p<0.01) ; *Significant at level (p<0.05)						

Table 5 ANOVA test to Comparer means for Physical Environment

Zone	N	Mean	Std. Deviation	F-test	p-value
A	28	4.16	0.559	8.652	0.000**
B	40	4.51	0.269		
C	106	4.22	0.416		
D	86	4.40	0.319		
Total	260	4.32	0.403		

**Significant at level (p<0.01)

Table 6 Multiple Comparisons for Physical Environment factors

LSD						
(I) Zone		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
A	B	.35668*	0.09506	0.000	-0.5439	-0.1695
	C	0.06036	0.08198	0.462	0.2218	0.1011
	D	.23977*	0.08394	0.005	0.4051	-0.0745
B	A	.35668*	0.09506	0.000	0.1695	0.5439
	C	.29632*	0.07159	0.000	0.1553	0.4373
	D	0.11692	0.07384	0.115	0.0285	0.2623
C	A	0.06036	0.08198	0.462	0.1011	0.2218
	B	.29632*	0.07159	0.000	0.4373	-0.1553
	D	.17940*	0.05599	0.002	0.2897	-0.0691
D	A	.23977*	0.08394	0.005	0.0745	0.4051
	B	0.11692	0.07384	0.115	0.2623	0.0285
	C	.17940*	0.05599	0.002	0.0691	0.2897

*. The mean difference is significant at the 0.05 level.

3.1. Analysis of the research hypothesis: This research has four hypotheses as follows:

Hypothesis 1: There is a positive relationship between the physical environment factors and creativity variables (Imagination, curiosity and play) in kindergartens.

Table 7 Correlations matrix, n=260

		Physical Environment	Imagination	Curiosity	Play
Physical Environment	Pearson Correlation	1	.893**	.881**	.841**
	Sig.		0.000	0.000	0.000
Imagination	Pearson Correlation		1	.739**	.546**
	Sig.			0.000	0.000
Curiosity	Pearson Correlation			1	.653**
	Sig.				0.000
Play	Pearson Correlation				1
	Sig.				

** Correlation is significant at the 0.01 level (2-tailed).

The Person correlation Coefficient Table 7 shows that the relationship between physical environment factors and creativity variables (Imagination, curiosity and play) is a significant relationship. For instance, the relationship between physical environment factors and imagination is (.893) with p-value of 0.00 which is less than significant level (0.05). the same is true for the curiosity and plays factors. So, the relationship between physical environment factors and creativity factors is highly significant, in another word increase each of physical environment factors is proportional to increase the creativity.

Hypothesis 2: The use of natural elements in kindergartens fosters children's creativity by motivating their feelings about their surroundings and has a positive effect on their motivation to play.

Table 8. Regression analysis -Effect (Natural Elements/Creativity)

Independent/Dependent	Creativity			
	Constant	B(Slop)	F	R2
Natural Elements	3.609	0.156	37.373	12.70%
	t-test (29.559)	t-test (6.113)	p-value (0.000**)	
	p-value (0.000**)	p-value (0.000**)		

**Significant at level (p<0.01)

A Simple liner regression Analysis shown in Table 8., illustrates that the natural elements as a physical environment factor has a positive effect on the creativity. The B(slope) = 0.156 which is the amount of effect.

$$y = b_0 + b_1x_i$$

$$creativity = 3.609 + 0.156 \text{ natural element}$$

This regression equation determines the effect of the natural elements on creativity. It shows that changing natural element by 1-unit affects the creativity by the amount of (0.156). In general, the model is significant based on the F test= 37.373. Regarding the R2 which is the measurement that shows the percentage of changes in creativity by natural elements, according to the result (12.70%) of creativity is obtained via providing natural elements in the kindergartens.

Hypothesis 3: The factor of (safety and security) is available in most of kindergartens in Erbil city.

Table 9 Availability of safety and security

		Number	%
Safety 1	Available	19	79.2%
	Not available	5	20.8%
Safety 2	Available	20	83.3%
	Not available	4	16.7%
Safety 3	Available	18	75.0%
	Not available	6	25.0%
Safety 4	Available	17	70.8%
	Not available	7	29.2%

The result of hypothesis 3 shown in Table 9 obtained by checklist which is an instrument done through the observation of the twenty-four studied kindergartens. The table above shows the number and percentage of availability and non-availability of each of the safety indicators in the kindergartens. The result shows that the safety and security factors are available in the studied kindergartens by more than 70% which is a good rate.

Hypothesis 4: Using warm colors and proper lighting in kindergarten has an effective role in increasing children's creativity.

**Significant at level (p<0.01)

A Simple liner regression Analysis shown in Table 10 illustrates that the color and lighting as a physical environment factor has a positive effect on the

Table 10 Regression analysis -Effect (Color and lighting/Creativity)

Independent/Dependent	Creativity			
	Constant	B(Slop)	F	R2
Color and lighting	2.426	0.435	204.882	44.30%
	t-test (17.952)	t-test (14.314)	p-value (0.000**)	
	p-value (0.000**)	p-value (0.000**)		

creativity. The B(slope) = 0.435 which is the amount of effect.

$$y = b_0 + b_1x_i$$

$$creativity = 2.426 + 0.435 \text{ Color and lighting}$$

This regression equation determines the effect of the color and lighting on creativity. It shows that changing in color and lighting by 1-unit affects the creativity by the amount of (0.435). In general, the model is significant based on the F test = 204.882. Regarding the R2 which is the measurement that shows the percentage of changes in creativity via color and lighting, according to the result (44.30%) of creativity is obtained by proper color and lighting in the kindergartens.

3.2. Analysis of the research questions:

1- What is the most effective strategies in increasing children's creativity in kindergartens?
To get the answer of this question, 300 respondents who were parents that have children of kindergarten ages were asked in a multi choice question. As shown in Table 11, 131 of 300 respondent prefer a space with natural elements (water, soil and plants) as the most effective strategy in increasing children's creativity in kindergartens.

Table 11 The most effective strategy in increasing creativity

Strategies	Frequency	Percent
Using curved forms in classes instead of traditional square and rectangular forms	40	14.0%
Combination of open and closed spaces	46	16.1%
Creating a space for painting and music	68	23.9%
Creating a space to play with water, soil and plants	131	46.0%
Missing	15	5.3%
Total	300	100.0
Valid	285	

2- Which physical environment factors in a kindergarten are more effective on the variables of children's motivation to play, curiosity, and imagination?

Before answering this question and indicating the most effective factors on creativity in children there is the measurement named (KMO and Bartlett's Test) should be used in advance. As Table 12 shows the high significance. so, the factors can be analyzed.

Table 12. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.827
Bartlett's Test of Sphericity	Approx. Chi-Square	651.765
	df (degree of freedom)	55
	Sig.	0.000

The table below shows the (Total variance explained) which depends on Eigenvalues, if the Eigen value is more than 1 it shows significant,

while if its less than 1 it shows non-significant. So, after the data reduction the factors transformed to three groups according to their significance. The three groups whose Eigenvalues are more than 1 are significant and more effective. Table 13

Table 13 Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.748	34.074	34.074
2	1.149	10.444	44.519
3	1.105	10.046	54.565
4	0.913	8.298	62.863
5	0.818	7.432	70.295
6	0.758	6.888	77.184
7	0.659	5.988	83.172
8	0.584	5.307	88.479
9	0.459	4.171	92.651
10	0.431	3.921	96.571
11	0.377	3.429	100.000

Extraction Method: Principal Component Analysis.

Table 14. Rotated Component Matrix^a

Domain	Component		
	1	2	3
Diversity	0.747		
Color and lighting	0.698		
Variety	0.671		
Safety and security	0.659		
Visual elements	0.610		
Natural Elements			
Flexibility of performance		0.789	
Material		0.670	
Design of internal spaces		0.583	
Privacy			0.763
Complexity			0.637

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization. ^A

a. Rotation converged in 6 iterations.

As a result, the most effective physical environment factor to creativity is diversity as shown in Table 14.

3- Is there a relationship between the questionnaire result and checklist result?

In order to indicate the relationship between the questionnaire and checklist result, the tables below show the agreement of respondents of the physical environment factors and the availability of each of these factors in the studied kindergarten of this research. Table15, Table 16.

Table 15. Availability of physical environment factors in the studied kindergartens

		Number	%	
Variety1	Available	24	100.0%	49.2%
	Not available	0	0.0%	
Variety2	Available	16	66.7%	
	Not available	8	33.3%	
Variety3	Available	19	79.2%	
	Not available	5	20.8%	
Variety4	Available	0	0.0%	
	Not available	24	100.0%	
Variety5	Available	0	0.0%	
	Not available	24	100.0%	
Flexibility1	Available	4	16.7%	6.9%
	Not available	20	83.3%	
Flexibility2	Available	0	0.0%	
	Not available	24	100.0%	
Flexibility3	Available	1	4.2%	
	Not available	23	95.8%	
Diversity1	Available	10	41.7%	34.2%
	Not available	14	58.3%	
Diversity2	Available	13	54.2%	
	Not available	11	45.8%	
Diversity3	Available	15	62.5%	
	Not available	9	37.5%	
Diversity4	Available	0	0.0%	
	Not available	24	100.0%	
Diversity5	Available	3	12.5%	
	Not available	21	87.5%	
Design of internal space1	Available	2	8.3%	40.6%
	Not available	22	91.7%	
De sign of internal space12	Available	16	66.7%	
	Not available	8	33.3%	
De sign of internal space13	Available	20	83.3%	
	Not available	4	16.7%	
De sign of internal space14	Available	1	4.2%	
	Not available	23	95.8%	
Complexity1	Available	0	0.0%	27.8%
	Not available	24	100.0%	
Complexity2	Available	18	75.0%	
	Not available	6	25.0%	
Complexity3	Available	2	8.3%	
	Not available	22	91.7%	
Safety and security1	Available	19	79.2%	77.1%
	Not available	5	20.8%	
Saf ety and security12	Available	20	83.3%	
	Not available	4	16.7%	
Saf ety and security13	Available	18	75.0%	
	Not available	6	25.0%	
Saf ety and security14	Available	17	70.8%	
	Not available	7	29.2%	

Material1	Available	1	4.2%	2.1%
	Not available	23	95.8%	
Material2	Available	0	0.0%	20.8%
	Not available	24	100.0%	
Lighting & colors1	Available	0	0.0%	66.7%
	Not available	24	100.0%	
Lighting & colors2	Available	0	0.0%	10.8%
	Not available	24	100.0%	
Lighting & colors3	Available	15	62.5%	8.3%
	Not available	9	37.5%	
Visual elements1	Available	16	66.7%	
	Not available	8	33.3%	
Natural elements1	Available	1	4.2%	
	Not available	23	95.8%	
Natural elements 2	Available	1	4.2%	
	Not available	23	95.8%	
Natural elements 3	Available	3	12.5%	
	Not available	21	87.5%	
Natural elements 4	Available	7	29.2%	
	Not available	17	70.8%	
Natural elements 5	Available	1	4.2%	
	Not available	23	95.8%	
Privacy1	Available	1	4.2%	
	Not available	23	95.8%	
Privacy2	Available	3	12.5%	
	Not available	21	87.5%	
Privacy3	Available	2	8.3%	
	Not available	22	91.7%	

Table 16. The kindergarten teacher's agreement on physical environment factors

	Mean	Std. Deviation	% agreement
Design of internal spaces	4.3088	0.66801	86.18%
Flexibility of performance	3.6548	0.86899	73.10%
Natural Elements	4.6798	0.92823	93.60%
Color and lighting	4.4026	0.62439	88.05%
Safety and security	4.6490	0.80007	92.98%
Visual elements	4.3481	0.64049	86.96%
Diversity	4.6154	0.57636	92.31%
Complexity	4.1673	0.79567	83.35%
Privacy	3.9846	0.90460	79.69%
Variety	4.3808	0.75925	87.62%
Material	4.2769	0.90058	85.54%

The comparison of the factors in the questionnaire and checklist tables reveals no relationship between respondent agreement with the factors and the accessibility of factors in kindergartens. When the teachers were interviewed, they expressed

their desire and acceptance for the qualities listed in the questionnaire, however the majority of the factors are not available in their kindergartens. For

example, the agreement of teachers about the natural element factors is 93.60%. while the existence of the natural elements in kindergartens is 10.8 %.

4-Which space among the spaces with natural elements children most prefer?

Generally, the teachers highly agreed on the importance of natural element factors, but in order to gain more precise information, parents were asked about which type of spaces with natural elements their children prefer. Out of the 300 respondents surveyed, 289 gave their opinions on this matter; 11 did not. The findings demonstrate that parents prefer spaces with natural elements, whether they are spaces for keeping animals, spaces for growing plants, or spaces with colored glass and water as shown in Table 17.

This findings emphasis the importance and preference of natural elements by parents as well, thus increasing of natural elements in kindergartens is vital among all physical environment factors to increase children's creativity.

Table 17. The most preferred space among the spaces with natural elements

	Frequency	Percent
A space full of water and colored lights	72	24.9%
A space for growing plants	32	11.1%
A space for keeping animals	86	29.8%
All three cases	99	34.3%
Missing	11	3.8%
Total	289	100.0

4. Conclusion:

This study aimed to examine the effect of physical environment factors on the creativity in children. Hence, the study conclusively found and answered the research objectives, the research questions, and also offered proof to all the articulated research hypothesis. Based on this study the relationship between physical environment factors and creativity is highly significant, in another word increasing each of physical environment factors will increase the creativity. The physical environment factors have a positive effect on creativity. For instance, natural elements as a factor of physical environment have a positive effect on the creativity according to the result of this study. The result also shows

the positive effect of color and lighting on the creativity. After comparing the teacher's questionnaire and the checklist of the studied kindergartens in this research the result shows that there is not relationship between them. As the teachers admit their desire for the factors that cause children's creativity but the few of these factors are available in kindergartens in Erbil city, this problem must be addressed, and conducting this study will, hopefully, yield results. The parents have a great role in the development of their children as they were a part of this research by responding the questions related to the effects of physical environment factors or the role of interior spaces of kindergartens in enhancing creativity in children.

References:

- [1] Ahadzade, M. and Dashti Shafei, A. (2013) 'Qualitative principles for designing children's educational environments based on nurturing creativity approach', *European Online Journal of Natural and Social Sciences*, 2(2), pp. 174-181. Available at: www.european-science.com.
- [2] Altounsi, S.S.B., 2018. *Kindergarten design and enhancement: A case study in Libya* (Master's thesis).
- [3] Arabyat, A., B., 2020. The Impact of the Quality Designed Learning Environment on a Child's Behavior in Kindergarten Stage. *Journal of Civil & Environmental Engineering*. Vol. 10:6, DOI: 10.37421/jcde.2020.10.364.
- [4] Azeri, A.R.K. *et al.* (2016) 'Design principles of residential space to enhance children's (3-7 years old) creativity in iran (Case study: Tehran district 4)', *Bagh-E Nazar*, 13(41), pp. 23-38. Available at: <http://www.en-sani.ir/storage/Files/20161016104505-9604-176.pdf>.
- [5] Babatugon, J.A. (2014) 'Nurturing locus: how can architecture nurture inspiration and ideas in creative thinking?' Available at: <http://unitec.researchbank.ac.nz/handle/10652/2554>.
- [6] Foroushi arges, Nazanin Nasrolla and BehzadVasigh. 2013. *The Architectural Solutions in Designing the Children's Space Based on a Creativity-promoting Approach*, The National Conference of Architecture, Culture and Urban Management, Karaj, The center of scientific-practical education of Karaj municipality.

- [7] Hamraz, H., 2021. The role of kindergarten architectural design in increasing the creativity of children. *Science and Education*, 2(12), pp.146-151.
- [8] Han, H.S., 2020. Analysis on Preferred Element on Constructing Creative Play Space Design. *Journal of Digital Convergence*, 18(10), pp.389-396.
- [9] Homayooni E., Imantalab H., Yousefi E., 2016, The role of architectural spaces in promoting children's creativity and developing their intellect. Vol.2, Issue 1, Pages 30-34.
- [10] Jalili, t. and shaabani, r. (2016) *from the natural creativity to the influence of educational spaces on training creative children, | iioabj |*. available at: www.iioab.org.
- [11] Kail, R.V. and Barnfield, A., 2007. *Children and their development* (pp. 119-120). Pearson Prentice Hall.
- [12] Leggett, N. (2017) 'Early Childhood Creativity: Challenging Educators in Their Role to Intentionally Develop Creative Thinking in Children', *Early Childhood Education Journal*, 45(6), pp. 845-853. doi:10.1007/s10643-016-0836-4.
- [13] McCoy, J.M. and Evans, G.W. (2002) 'The potential role of the physical environment in fostering creativity', *Creativity Research Journal*, 14(3-4), pp. 409-426. doi:10.1207/S15326934CRJ1434_11.
- [14] Mohidin, H.H.B., Ismail, A.S. and Ramli, H.B., 2015. Effectiveness of kindergarten design in Malaysia. *Procedia-Social and Behavioral Sciences*, 202, pp.47-57.
- [15] Nikolić, V., Keković, A., Stanković, D. and Tanić, M., 2013. Remodeling of the interior of preschool institutions in the context of improvement of ambient value and quality of space. *Facta universitatis-series: Architecture and Civil Engineering*, 11(3), pp.211-220.
- [16] Pawlak, A.M. (2000) 'Fostering Creativity in the New Millennium', *Research-Technology Management*, 43(6), pp. 32-35. doi:10.1080/08956308.2000.11671393.
- [17] Puma-Yagua, K.A., Ramos-Quispe, T., Castro-Cuba-Sayco, S.E., García-Holgado, A., Sprock, A.S. and Villalba-Condori, K.O., 2020. The physical space and the development of creativity in peruvian early childhood education: a case study in Arequipa. *International Journal of Learning, Teaching and Educational Research*, 19(2), pp.203-213.
- [18] Rachmawati, R. (2014) 'the Importance of Interior Design for Children' S', (Novem
- [19] Sakarya, T.H.E. and Of, J. (2018) 'No Covariance Structure Analysis of Health-Related Indices for the Elderly at Home, Focusing on Subjective Feelings of HealthTitle', 7(2), pp. 44-68.
- [20] Shafaei, M. and Madani, R., 2010. Design principles of educational facilities for children based on creativity. *Journal of Educational Technology*, 4(3), pp.215-222.
- [21] Shahosseini S. and Saghafi R. M., (2018), Creative Environments at Children's Club, MANZAR, 10 (44): 24-39 / November 2018 DOI: 10.22034/manzar.2018.76862
- [22] Suk han H., (2020), Analysis on Preferred Element on Constructing Creative Play Space Design, *Journal of Digital Convergence* Vol. 18. No. 10, pp. 389-396, 2020 <https://doi.org/10.14400/JDC.2020.18.10.389>
- [23] Thoring, K., Mueller, R.M., Desmet, P. and Badke-Schaub, P., 2018. Design principles for creative spaces. In *DS 92: Proceedings of the DESIGN 2018 15th International Design Conference* (pp. 1969-1980).
- [24] Xiaoxian S. and Meicheng W. Spatial Color Analysis of Kindergarten Interior Design Based on Children's Psychological Activities in Digital Environment. *E3S Web of Conferences* 236, 05011 (2021). ICERSD 2020
- [25] yosita, l., 2000 the relationship of children's playing-space and the growth of creativity: a comparison study between condition in. pages: 1-11