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CHANGEABLE DESIGNS IN PRESCHOOL EDUCATION ENVIRONMENTS: SUPPORTING SENSORY DEVELOPMENT AND CREATIVITY

B. Ece Şahin[1i], Neslihan Dostoğlu[2]
[1]Faculty of Architecture, Department of Architecture,
Uludağ University, Turkey
.[2]Faculty of Architecture, Department of Architecture,
İstanbul Kültür University, Turkey

Abstract:
Preschool education has special importance in the development processes of children at 3-6 age, which is the period when the foundations of individual development are established. In this period, the development of children is supported by education and appropriate environmental conditions, and in this context, the quality of the physical environment has great significance in education process. Today, the development of creative thinking of individuals is considered as one of the conditions which improve the standards of societies. Since creative thinking is significantly developed and formed in preschool period, the improvement of children's creativity is considered as one of the objectives of preschool education. In this context, proposes a design approach taking changeability as its basis to support creative thinking of children in preschool environments. This paper is based on the findings of a doctorate thesis, integrating preschool education and architecture, completed by B. Ece Şahin at Uludağ University Department of Architecture, under the supervision of Prof. Dr. Neslihan Dostoğlu. The research was carried out with 30 children of age 5 in three public kindergartens in Bursa. Methods used in the study can be described as; discussions through the images of changeable toys, watching a movie about changeability, drawing a desired classroom and discussions held during a computer game where the action of change is experienced. In the research, it has been observed that changeable designs, support mental activity by stimulating feelings, encourage to think differently and to propose new ideas. Changeable designs can be consider as the products of design which trigger

[i] Correspondence: email easatekin@yahoo.com

imagination. In this context, changeability can evaluate a parameter in designing education environments in order to support creativity in preschool years.

Keywords: preschool education, child development, changeable designs

1. Introduction: The Sensory Development and Creativity in Preschool Educational Perspective

The developmental characteristics of human life are substantially shaped during the 0-6 age period, which is also identified as the preschool or early childhood. During these years, a rapid development is observed in all fields related with children. For instance, it has been determined that 50% of cognitive enhancement is completed until 4 years, 80% until 8 years, and the education provided during 0-6 age period has 33% influence on school success of children. The development of personality, social sensibility and creative intelligence begin to form during that period (Başal, 1998; Poyraz and Dere, 2001; Kartal, 2008). While the concept of care is generally important for the development of children between 0-3 years old, it is necessary to support the development of 3-6 year old children. In fact, children who get preschool education are more successful in their further educational processes and acquire positive improvements in social, cognitive, behavioural and personal aspects (Sylva and Roberts, 2010). Supporting the development of children during this period is also essential in fulfilling the first and most important condition of social improvement and ensuring a basis for earning a life-long learning approach. In this context, preschool educational process is more important in comparison with other educational processes.

One of the most important cognitive characteristics that individuals should have in the 21st century is creativity. From this point of view, the preschool educational process has a special importance because it has the potential of exposing creativity in children. Creativity can be identified as applying an original approach to known facts, producing specific solutions for particular problems, establishing relations which could not be established previously and thus putting different ideas and products within the scope of a new thinking scheme (Argun, 2004). The existence of creative individuals who are vision holders, observant, reactive to problems and deficiencies, open to cooperation is considered necessary for improving society (Robinson, 2001; Üstündağ, 2009; Oktay, 2007; Yanık, 2007). In this context, educational processes are expected to provide environments for developing creativity as a natural-born ability of children. In various studies, the necessity of supporting creativity, which children naturally have, and the importance of revealing creative thinking, which the individuals have from

early ages by means of environmental conditions and proper education, is emphasized (Argun, 2004; Turla, 2007, Üstündağ, 2009, Kasap, 2008; Toğrul, 2007; Oktay, 2007). Gardner (2007) expresses the importance of providing choices in education in order to obtain a creative perspective and identifies the children of preschool period as an age group which can easily adopt a creative way of thinking without much effort. Presenting rich sensory stimulants to a child plays a very important role in revealing his/her creativity.

In history, there are various examples of educational approaches dealing with the senses of children during early childhood. Although the studies important for developing the field are quite diverse, in this study, only the theories related with the subject and the associated points are taken into consideration in order to establish a relation between sensory development of children and consequently the development of creative thinking and changeability. The importance of education in early childhood has been emphasized first by Plato in Ancient Greece. The importance of sensory experience for development during preschool period was pointed out by Comenius in the 17th century, and during the same era John Locke stated that the environmental conditions play an important role in the development of people and a good environment would provide knowledge and experience for children. The importance for children to act without any restrictions and obstacles has been first emphasized by Rousseau in the 18th century (Oktay, 2001; Dudek, 2000; Pound, 2006; Poyraz and Dere, 2001; Wortham, 2002).

19th century is a period during which significant developments took place in preschool education. The first ideas underlying modern educational approach based on the belief that children can express themselves by means of several materials provided during the educational process and that children should be encouraged to use these materials creatively, have been first put forward by Pestalozzi. Pestalozzi has tried to develop the educational capacity of children on forms, languages and numbers by means of materials intended for handcraft (Dudek, 2000; Krogh and Slentz, 2011). Froebel, who has benefited from the experience of Pestalozzi during the second half of the 19th century, built a system based on games rather than discipline, for the creative development of children, and developed special educational materials for children. These educational materials are divided into two groups, specified as gifts and occupations. Gifts are game and construction materials consisting of 500 pieces and divided into groups as 1-2-3 and 4-6 in accordance with their geometric specifications and sizes. Froebel believed that he could understand the symbolism behind the games played by children and adopted the perspective that steady structures do not allow such development. Occupations are activities for developing children's manual

dexterity, such as weaving, paper folding, cutting, stick-laying, sewing on perforated cards, bead stringing (Pound, 2006; Krogh and Slentz, 2011). These materials of Froebel, which are considered as original in educational sense, allow children to create various forms in different combinations. These materials allowing children to build a bridge or a tower create significant influences on their development. In fact, a child constructing a building with blocks in a short period gains lots of confidence, and the senses of children in relation to concepts such as form, rate, harmony etc. are improved by adopting these forms without realizing. To support these ideas, the biographies of important architects, engineers and artists of the 20th century and their comments can be given as examples (Figure 1). For example, designers such as Buckminster Fuller, Frank Lloyd Wright, Le Corbusier, Kandinsky etc. were educated in the kindergartens where Froebel style education was applied, and the materials used in these kindergartens have become a source of inspiration for these designers' geometric and structural approaches (Pound, 2006; Dudek, 2000; Koralek and Mitchell, 2005).

Figure 1: The relation between Avery Coonley Playhouse designed by Frank Lloyd Wright and Froebel materials (Dudek, 2013)

The idea of using special materials in education was also applied through a similar system by Maria Montessori at the beginning of the 20th century for children with mental retardation and emotional problems. The behaviour of children while playing with materials in the Montessori's kindergarten in Rome, called "*Casa dei Bambini*" or "*Children's House*", was analysed in 1907. It was observed that children preferred playing by blocks and constructing a tower to playing with a baby, a ball or a train set, and that these children became more eager for socializing, and more effective in communication. In the Montessori school, the materials and furniture were designed to enable free, individual or joint use of children by providing alternatives for them. The freedom of action provided for the children, especially the freedom of their hands, has been accepted as necessary for their education and learning, and furniture suitable for

their size, which could be moved by them, have been used (Dudek, 2000; Krogh and Slentz, 2011; Pound, 2006).

At the beginning of the 20th century, several approaches have been developed based on these studies. These findings have been the basis of the modern educational approach of Dewey and the studies of Steiner where he emphasizes the importance of the relation with the senses. Beginning from the second half of the 20th century, the Cognitive Development Theory of Piaget (1963) has provided an important perspective for the educational process related with the learning of children during preschool period. This approach, which is identified as constructivism, has presented significant findings on the intelligence of children in their interaction with the environment (Wortham, 2002). In this context, educators have claimed that children need to have experience on materials and the real world actively in order to develop their own thoughts (Pound, 2006). Preschool education has thrived with contributions of various theories and approaches in history. A significant approach has been applied by the teacher Loris Malaguzzi after the Second World War in the first kindergarten opened in Reggio Emilia in Italy. In this program, known as Reggio Emilia, the child is considered as protagonist, powerful and capable, and it is aimed to develop and improve the communication levels, symbolic abilities and creativity of children (Pound, 2006; Cadwell, 2003; Wortham, 2002). In the Reggio Emilia kindergartens, the creative studio environments are compared with feasible containers where children can express themselves, and develop in accordance with their activities (Koralek and Mitchell, 2005). Another educational approach known with the importance it gives to choices of children is High/Scope. In this approach, a program is applied in a process where various materials are provided for children to make their own choices in accordance with the theory that these materials should be analyzed freely by children, with the expectation that the environment also provides a similar diversity and a functionality (Kartal, 2008; Dudek, 2000).

In the theories and approaches related with the development of mental enhancement and creative thinking of children during preschool period, significant gains are aimed by means of materials presented to children. In this context, it has been accepted that educational materials should be changeable by children in order to create various sensory stimulants for them. In this study, in consideration of the evaluated theories and approaches, it is claimed that the idea valid for the scale of materials can also be valid for the scale of the physical environment. It is assumed that the developmental contributions provided to children by the possibility of creating various forms can be supported by the existence of a changeable environment. In Table 1, the

relationship between the findings achieved from preschool educational perspective and the gains estimated through changeability in the physical environment is summarized.

Table 1: The relations predicted by the theories on the development of creative thinking by changeability

Preschool Education Perspective	Changeability in Physical Environment Level
Freedom given to children	Implementation of changes influencing spatial use in accordance with children's choices and flexibility formed by changeable nature of spaces
Diversity of relations established by senses	Diversification of sensory discoveries by means of diversity of spatial experience
Encouraging children towards implementing their own activities by means of several materials	Diversity presented by spaces with their changeable nature
Thought of using a material as a source of learning	Establishing physical environment as a part of learning
The perceptual and sensory acquisitions provided by the opportunity of creating various forms	The contributions ensured by the opportunity to create various forms in spatial scale by means of experiencing changes and effects
Experiencing the acquisitions of interaction process by materials reflected on life: biographies of designers and artists of the 20th century	The expectation of strengthening the acquisitions of an interaction with the physical environment through the potential of creating various experiences by the choice of children

In accordance with the predicted relations, it is anticipated that the sensory development and creativity of children can be improved by the changeability of the physical form of educational environments in accordance with the skills and abilities of children. The importance of relations established with senses is emphasized in various studies. For example, Day (2007) describes that the children are more creative than adults because they are in a process where they try to understand their environment by establishing relations with their senses. According to him, the relations established with senses are the foundations of thinking; thoughts are kept alive by means of rich sensory experience and stimulants changing due to spatial atmosphere. Similarly, Meerwein (2007) expresses that the cognitive development of children is related closely with the diversity presented by environment. According to Taylor (2009), the capacity of learning is directly related with the environment, which is expected to stimulate the senses of children through their relations with various materials. Walden (2009) indicates that development of different senses is provided by impulses and it is necessary to establish an active interaction with the environment. In this context, it is

considered that a changeable physical space can create an interesting environment which invites children for establishing interactions and sensory development and creativity can be supported by providing contribution to children for experiencing new sensory relations.

2. Changeability

In this study which claims that changeability should be taken into consideration as a design parameter in order for the physical environment to support sensory development of children in the design of preschool educational environments, it will especially be advantageous to identify the aspects of this parameter. Within the scope of the Ph.D. thesis which this study is based on, the concept of changeability is assessed on the levels in which the stimulants may have variability.

Four examples will be presented here in order to express the potential that the theme of changeability has. The design implemented by Hoffman Architects for Erika Man Elementary School can be considered as an example for interior design related with the concept of changeability (Figure 2). On the second floor of the school, a solution including various alternatives, which can be used by small children for group study, reading and discussions, is presented.

Figure 2: Erika Man Elementary School
(http://www.baupiloten.com/archiv/en/projekte/emg1/slideshow4/01.html;
http://www.baupiloten.com/archiv/en/projekte/emg1/slideshow4/07.html;
http://www.baupiloten.com/archiv/en/projekte/emg1/slideshow4/06.html).

The "*Cafeteria Technical University Berlin*" can be shown as another example where the concept of changeability is presented (Figure 3). In this design, the options for changing illumination colours according to seasons have been created to take advantage from the psychological effects created by colours. Furthermore, the various uses of furniture

according to seasons have been taken into consideration, and it has been ensured that elements have been used according to various preferences.

Figure 3: The changes of winter, spring and summer atmosphere
(http://www.baupiloten.com/en/projekte/cafeteria-wetterleuchten-2/)

In a structure which has been constructed during a regional festival of Australia, the aim has been to give the structure various appearances, to control and change illumination in accordance with personal requirements of its users, by means of sliding panels (Richardson, 2007), (Figure 4).

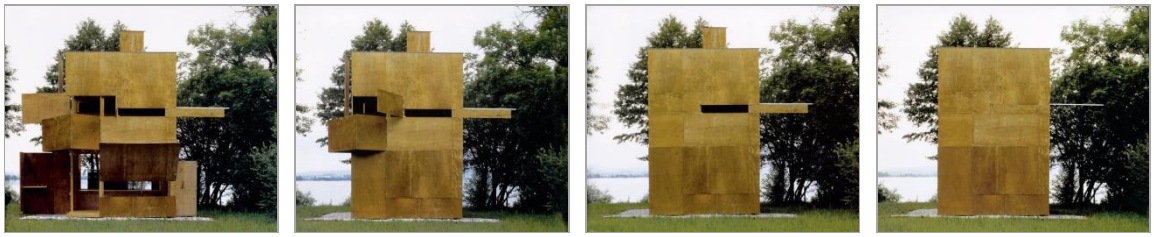

Figure 4: GucklHupf-Mobile Lookout
(http://transformabledesign.com/project/a-2-1-gucklhupf-mobile-lookout/)

In Slovenia, the shell of the structure of Kekec Kindergarten, which has been designed by Jure Kotnik, has been expressed as a toy (Figure 5). The freely moving panels used on three facades of the kindergarten, with one side in natural wood and the other side painted in 9 different colours, have been expressed as a game and learning tool which allow children to experience various colours (Kotnik, 2011). In these examples, the potential of changeability in creating various stimulants can be seen easily. This supports the judgment that a dynamic structure, which keeps mental activity alive, invites children to interact, increases motivation and attention of children, can be provided by interpreting it as a parameter in the design process of changeability.

Figure 5: Kekec Kindergarten
(http://ad009cdnb.archdaily.net/wp-content/uploads/2011/03/1299532195-kekec72dpi-18.jpg;
http://ad009cdnb.archdaily.net/wp-content/uploads/2011/03/1299532050-kekec72dpi-8.jpg;
http://ad009cdnb.archdaily.net/wp-content/uploads/2011/03/1299532275-kekec72dpi-26.jpg).

3. Method

In this study, changeability is identified as a design parameter for preschool educational environments to support the development of children. When the theories and approaches related with preschool education are analysed, it is observed that the proposed parameter has a strong relation with the issues which are significant in developmental aspects. In the case study which has been implemented, the aim has been to learn how children consider changeable designs and to identify the impact of interaction with these designs. Considering that there is a possibility that children can make various remarks according to their socio-cultural and economical status, the study was implemented in a total of 3 public kindergartens in three different districts with varying economic levels in Bursa. The study was established as a qualitative, comment based study in order to present more detailed images related with the subject. Participants in the study were limited with children between 60-72 months because this age group has the highest rate in preschool education in Turkey.

Various researchers indicate that children are willing to participate in a study and perform a correct evaluation if correct and proper methods are applied during the preschool period. For example, Hart (1992) emphasizes that since children do not have the same communication skills as adults, we should be more sensitive with them and that we should apply new methods which develop their communication skills and make them more willing during that process. According to him, children have great desire for participation if adults spend enough effort to understand them. According to Clark (2005), children in preschool period are experts of their own lives and it is important to hear their voices. In his study, where he approaches the issue of the relationship between early childhood and the physical environment, he applies a methodology described as the Mosaic Method where he includes various tools of

expression. Various methods are included at the center of the preschool education, such as observation with children, one-to-one and group conversations, photography (allowing children to take photographs of the things they consider important), field trips, map making and dialogues with directors and parents. In these studies, apart from written conversation format, the methods by which children can reflect their creativity are used and the relations of children with their physical environment are tried to be understood by means of verbal and non-verbal methods (Clark, 2004; 2005; 2010).

Different methods are used in order to open various expression channels. In cases when visuals are used, these visual materials are either prepared jointly with children or presented to them as ready-made. These methods can also be applied together (Thomson, 2008). In this study, the second method was preferred in order to clarify the nature of changeability. Furthermore, the assumption was that children can express their thoughts by drawing pictures. In fact, drawing is a tool by which children reflect themselves until they learn how to read and write. The possibility that children can express their feelings and ideas more easily by creating images, the fact that children from preschool age group can present more accurate expressions about the pictures they draw, and the satisfaction that children experience in such a study were effective in choosing this method (Lange-Küttner, 2008; Leitch, 2008; Holmes, 2005; Ross, 2008). Moreover, the necessity to evaluate this subject through the contribution of various opinions, which is called triangulation, was taken into consideration in relation to early childhood studies (Holmes, 2005). In this context, three perspectives were obtained from children, teachers and parents.

Through the study, the concept of changeability has been emphasized. It was concluded that children meet with the theme of changeability by means of toys, as products of design which have great significance in their lives. In this context, the first step of this study was to understand how the children evaluate the changeability theme applied on toys (colour changing cars, baby dolls or toys with changeable functionalities). Inspired from the conversation method applied by Sanoff (1991) through the photographs included in his participatory design studies, a conversation form which consisted of three toys with changeable and stationary characteristics and furniture sample photographs were used to evaluate how children consider changeable designs (Figure 6). The furniture design sample was used to make an analysis before other phases of the study in order to determine how children would assess a changeable subject other than toys. Within the context of this form, one-to-one conversations were held with the children, their teachers and parents. The children who analysed the image were first asked "*which one did they want to buy and why*"; and in

order to canalize the subject, the questions as "*whether they have such toys or not, what are these toys used for, how it feels to change them, what the differences of these toys from the others are, and whether it becomes boring to change these toys after a while*" were directed. Their teachers and parents were asked whether they had any opinion on the choice of their children, which toys they would prefer for them and the reason behind this.

Figure 6: Two samples used in photo-conversation form

In the next phase of the study, a short-movie with changeable furniture samples was presented to children in order to express the potential of changeable designs on children more clearly. The videos used in this short-movie were obtained by using a video portal of the internet by searching "*changeable furniture, flexible furniture*" terms (Figure 7). After, this short-movie was presented to children, a group discussion was held with them as the first phase. In order to encourage different ideas, the questions as "*whether they have liked the images they watched or not, whether they would like such things in their classes and how they would use such things if they had them in their classes*" were directed to them by brainstorming. The participation of their teachers as observers was requested in order to obtain their comments and opinions on the feelings and interest levels of children related with that movie. Throughout the discussion process with the teachers, it was asked whether it would be advantageous to use the designs they saw in the film in preschool environments; they were requested to imagine different designs, which they could use in their classes and to assess the interest of children in these designs.

Figure 7: Frames from the short-movie

In the following phase of the study, picture drawing was included as a method in which children could express their thoughts individually. In this study, the statements of the children on the pictures they drew were taken into consideration (Thomson, 2008; Holmes, 2005). In order to eliminate the possibility that there might be a difference between the associations evoked in the mind of the researcher and the thoughts of children, which is emphasized as an important issue in visual study processes of various studies, one-to-one dialogues were established with children and their comments on these pictures were evaluated. Time was given to children for telling what they saw in their own drawings.

In the final phase, in order to see the interest created by the action of changing, considering the fact that there was not any exemplary environment where this experience could be provided, it was questioned whether it would be possible to perform an evaluation by using a computer game. In order to see the interest levels of children while playing games individually and to obtain their comments and ideas; children who tried several choices were asked whether they liked the game they played, whether they have played a similar game before, whether they would like if there are things in their classroom which they could change and whether they found the game fine, funny or boring, by using a computer game which the children could diversify according to their preferences (Figure 8).

Figure 8: Images from the computer game used in the study
(http://www.oyunlar1.com/games.php?flash=5746)

4. Results

In the first phase of the study which was performed through photographs, it was observed that the toys with changeable characteristics and/or issues were preferred rather than the static ones. In the statements of the children, it was observed that the toys and furniture presented in the examples, the diversity of their colors and functionalities stimulated senses such as excitement, curiosity, fun and satisfaction.

> *Gülse (3): I have seen such changeable toys. A normal ball, I have handled and squeezed it under my foot, the ball got bigger and surprised me. I would buy the changing baby doll because its colors change. It is very beautiful. I have also a baby doll with colorful hair, it changes colors in water, I feel very different when it changes, "I fall into a coma" (she is very excited while she was telling that and uses that word).*
> *Batuhan (1): I would like the changing ball, if blue does not shine while changing or red does not shine, maybe green shines. I already have changeable toys, I have a car which turns into yellow in hot water and orange in cold water. Changeable toys are more beautiful and funny.*
> *Yağmur (3): I would like the changing sofa because it is beautiful and it is fun to change it. I would be very happy while it is changing.*

In this context, as indicated by Taylor (2009), Meerwein (2007) and Day (2007), increasing learning capacity and improving creative thinking, imagination and different sensory centers is essential for establishing an environment which supports sensory development and creativity of children. Taking advantage of designs with changeable characteristics in preschool education environments is taken into consideration as an accurate and proper decision in order to increase the number and diversity of stimulants which children experience. The statements indicate that it is possible to provide interesting, exciting and engaging environments by means of changeability.

4.1 Watching a movie and group conversation

After the short-movie, showing furniture designs with changeable characteristics, was shared with the children, the questions such as "*do you like the movie you have seen*" were directed to them. Then, a conversation on "*what would the children use such things for*" was held and the children were assisted for consideration by a question as "*what would you do with that extending sofa if it was in your classroom"*. The study was concluded by a brainstorming on "*what would be the things they would like to use in their classroom similar to*

the ones they have watched". While there was an assumption before the study that the interest levels of children would be lower because furniture unfamiliar for them was used, the result showed the opposite. The children wanted to see the movie again and this was considered as an indicator of children's interest during the discussions. In addition to these findings, it was observed that children could imagine different changeable designs and suggest using alternatives for designs after such an experience. Changeable designs are enabled to different relations and connotations in children's minds.

> *I wish when the table was moved, a dining table was formed; we could eat something in the class when we liked (1).*
>
> *We could make a road and drive our cars on it, if we had it in the class (2).*
>
> *We can make balance walk on the extended couch (3).*
>
> *The extended couch can be a table as we paint (2).*
> *It is very beautiful that the sofa is extending, I really like it very much. Actually, if it was multicolour, it would be more beautiful (1).*

During the movie phase where a closer relation was established by using changeable designs, it was observed that these designs led the children to think under the light of their own experience and consequently to create new and unique ideas.

4.2. Painting study and individual expressions

In this phase, it was requested from children to draw the classroom of their dreams and at the beginning, the purpose of the study was explained to them by the following question: *"how would your classroom become more beautiful?"* In order to make children relax before beginning to draw, it was stated that they could draw anything that would make their classroom more beautiful, it would not be a problem if they could not continue drawing when they had difficulty in imitating because everyone would have the chance to explain what they wanted to draw at the end of the session. In this context, it was expressed that it was important that everyone should draw on their own. No verbal communication was experienced among the children while drawing. The children focused on their drawings and continued their work and their thoughts were transferred on the paper in a short period. Therefore, it was accepted that some visual

interactions were not important, and it was predicted that children could attribute various meanings to the same drawings. As a result of the study, it was observed that this judgment was right. Similar figures were used by only two children among thirty, however during individual statements it was understood that there was not any exchange of ideas between them and that they attributed different meanings to these objects in their drawings.

Almost all children reflected the nature of changeability in their drawings. This situation was taken into consideration by their teachers as an important finding when it was indicated that the children did not reflect anything they did not like on their drawings. The tendency which began with a question of a student, such as "*can we draw two pictures?*", influenced the entire class and the children spent effort for drawing different things, and various ideas were presented by more than one picture. Within the scope of this study, the findings which supported the themes presented during photo-dialogue, post-movie group discussion and brainstorming were obtained. Changeability was found to be interesting because it turned into a form in accordance with the idea or preference of the children (Figure 9).

Figure 9: Drawing of Sude (1)

"When you touch the window, the glass of the window becomes the colour you want. This is an extended couch (black colour), this is also an extended couch (green colour and dotted), sitting on it feels good. There are colourful Legos; they do not have any function. This is a toy, as it becomes wet; it changes to multicolour, the colour changes."

In addition, the findings obtained during the drawing process related with the nature of changeability stimulated the ambition of the children to make suggestions on what they saw and what they imagined. Changeable designs contributed to children for establishing various associations and relations in their minds. Children were observed

to reinterpret the changeable designs, which they had seen before, in order to make them suitable for their own desires and requirements. In these suggestions, it was observed that the furniture which was light brown due to its raw material paper, which was identified by them as an extending sofa, could be reinterpreted by children in a way to reflect the diversity they looked for; they reflected that furniture with its new colourful form in accordance with the existing function which they liked (Figures, 10, 11 and 12), and moreover they suggested different functions for that design which could be used for various purposes as a seating element (they imagined the extending sofa as a bridge and/or road for their cars) (Figure 13).

Figure 10: Drawing of Simay (2)

"This is an extending sofa; I think it would be more beautiful if it was colourful like that (it was drawn in multiple colours with bends) this is a heart-shaped green pillow. I could collapse these sofas easily and turn them into different forms."

Figure 11: Drawing of İsmail Emir (2)

"This is our shoe cabinet (with the triangle form on top) and this can be turned into a bed but ours cannot, we could lie when we are tired. These are the windows without grills (with purple frames) and this is the extending sofa, I would like it if it was colourful, it would be more beautiful in that way. Also, the blue sofa can be changed."

Figure 12: Drawing of Minel Sude (1)

"A double-decker, sometimes it changes colours. This is also a bendable sofa but mine is more fancy (coloured)."

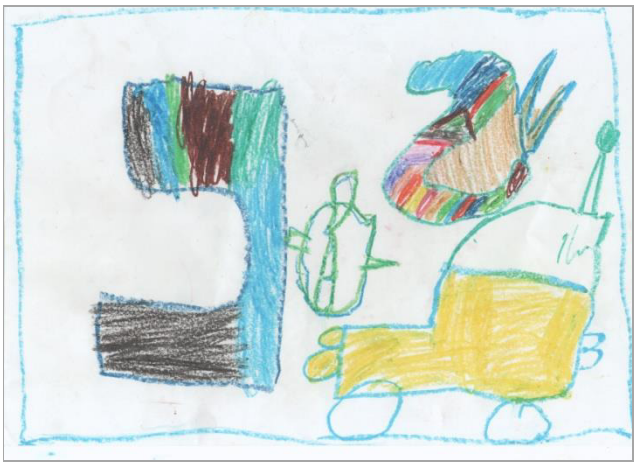

Figure 13: Drawing of Recep Taha (2)

"This is the extending sofa with an extending sofa cabinet, it becomes a bridge. This is also another extending sofa, but its colour changes. I would turn that sofa into a door, I would use it as a toy box and this car is a toy which changes colours."

The children who were introduced with changeable design examples, behaved eagerly to reinterpret the designs presented to them in accordance with their taste and

generate new suggestions. Moreover, they found out that it was possible to integrate various functions into a positive design, and from this point of view they could imagine new designs with multiple functions which combined various possibilities (Figures, 14, 15 and 16). These findings indicated the accuracy of acquisitions that support creative thinking by keeping children in a changeable environment.

Figure 14: Drawing of M. Kağan (1)

"I would like a bed which turns into a cabinet, while mine's colour changes. These are changing sofas. This device turns into a (the things it turns into are drawn connected to two levers in the middle of the paper) computer, a mp3 player, a camera, a phone and a bed changing colours when you touch it. I have drawn a foldable table (grey), it turns into a bed when you open its cover."

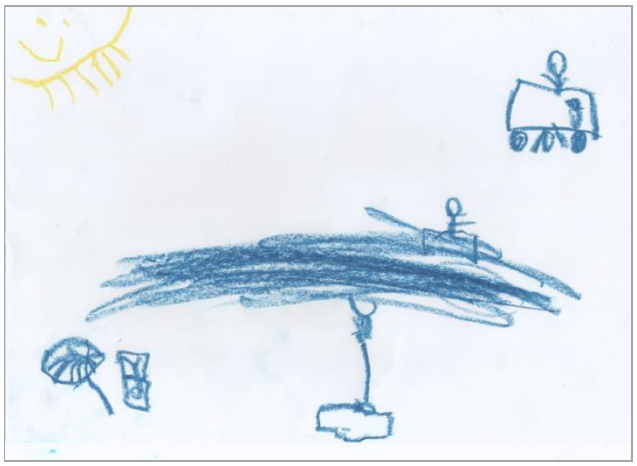

Figure 15: Drawing of M. Kağan (1)

"It means that we are going to a place for having a picnic but there is not any sea. We take a luggage with us, then when we pull on its handle, it turns into sea, an umbrella, a sun bed and a water ski."

Figure 16: Drawing of Didar (1)

"The door of this school turns into multiple colours and its lamp (he/she wants to draw a ceiling) also becomes colourful, it is always different, the way you want it."

The findings related with the changeability process can be summarized below:

- It was observed that children can reinterpret the changeable design examples they experience in accordance with their expectations.
- It was observed that finding changeable designs interesting can encourage children to create different forms and new ideas.
- Experiencing changeable design examples direct children to think of new designs with different functions (such as imagining a luggage which turns into a sun bed, a bag and several various features when it is required or the lighting apparatus which gives light in changing colours in the classroom).

4.3. Computer games and one-to-one conversations

In the study where computer games were used, almost all the children considered the action of changeability interesting. The children desired to try all options of the game, and thus feedbacks were given for incomplete options. It was observed that children were satisfied with the opportunity provided for making choices and none of them made a random choice. Related with changeable designs, it was observed that the feeling of curiosity became more prominent in this phase. It was indicated that such a game was played by them for the first time and the computer game phase was considered interesting. An assumption before the game was that the boys who would like more active games would not like such a game and would consider it as boring. However, both the boys and girls found the game, where the furniture in a room was

changed, interesting. The children stated that they would never become bored of such a game because it was beautiful to experience or do something different every time.

> *Nejdet Alp (2): Wonderful, wow! There are very different things. It is not boring at all.*
> *Researcher: Will you be bored if you play it long?*
> *Nejdet Alp (2): Never, because I like that very much. I have played it for the first time in my life, it is very different, there are lots of items which I have turned into different things. (New options appear after the next button on the screen is pushed) Wow! Are there new and changed items? Ooo, it is very beautiful, a season closet (a closet with leave figures has been described like this), let's see what this is?*
> *Didar (1): I think, this game is very beautiful, it is very funny to change items, it is not boring. It would be good to have that in the classroom, I would always change things, I would never be bored. I would like to change the closets, cabinets, rugs, lamps, tables and walls, it would be very funny.*

In this study, only a single child indicated that he/she did not like that game. However, at the end of the one-to-one dialogue, it was observed that this child desired that the changeability options of the game had been more, and wished that these changes would be in real life.

> *Sude Naz (3): I think this game is boring. It takes an hour for me to change things, because there are not too many different options in that game, there is only changing.*
> *Researcher: If it was real, would it be boring again?*
> *Sude Naz (3): If it was not a game but reality, I would like it then. It is boring in the game but it would not be in real life, I would do it in an hour but I would not be bored at all. When I did it, my school would be brand new and it would be as if I was coming to a new school.*

5. Evaluation

Many researchers indicate that sensory stimulants are variants and a physical environment which stimulates various sensory stimulants on children has the potential of supporting mental enhancement and creative thinking. In this context, changeability, based on its relation with the senses, has been taken into consideration as a parameter in designing preschool education environments. In fact, a physical environment where changeability is ensured can provide contribution to the development of children, by being formed in accordance with the preferences of children, and can produce various

sensory stimulants. Throughout the case study, findings have been obtained which support this hypothesis. Experiencing changeable designs has encouraged children to think differently and to create new solutions and suggestions. In this context, changeable designs can be considered as triggers which activate the imagination and the creative thinking of children.

Within the scope of this study, it has been tried to establish communication with children by various means such as conversations through photographs, only directing questions, watching movies and having group conversations, drawing a picture of the classroom of their dreams and playing computer games. It has been observed that the use of visuals have made it easier to extend the conversation due to the children's willingness to look at the pictures. In fact, watching movies attracted the attention of children the most, and became the most effective way to convey the desired feelings and thoughts of children. It was observed that the children who hadn't seen such furniture designs before could comprehend the theme in a short while. The accuracy of this judgment has been proven by observing that the children could identify new fields of use for the examples they had seen and create new suggestions reflecting that theme on their drawings related with the classroom of their dreams in accordance with their own requirements during the brainstorming process. It has been observed that the concentration level of children was high while they were drawing and they could express the information they had adapted related with the issue presented to them previously by going through their imagination and creativity. From this point of view, it can be suggested that it is important to see the creative potential of children by conveying their ideas through drawing pictures in accordance with an appropriate theme after information on that theme was provided to them in order to obtain individual and unique ideas from them. Various questions were asked by some children from the study group which could be considered as unattractive for them such as the materials used for a furniture they had seen in the movie, the stability and strength of the design and how a material becomes a bearing element while using it.

> *Nejdet Alp (2): We watched a movie tomorrow, what was the couch made from? The extended couch was taken by a boy, he walked on it.*
> *Researcher: It was made out of cardboard (It was understood later from his speaking that he asked the question to be sure from the conversations made that day).*
> *Nejdet Alp (2): I told to my mum, that it is a cardboard couch that it extends like a paste, a rubber, she was very surprised, it was very different.*

This interpretation can be defined that the child found the changeability feature in the movie so different and interesting he shared it with his family. He was interested by the material that he knows could be used for another different purpose, he shared it with his mother and to be sure he asked again the question although quite time was passed. This paper is an example indicating that the issues which the children from 60-72 months group are interested can be more sophisticated than the predictions of adults. It has been observed during the computer game process that the level of attention was high. In this context, it can be stated that it is necessary to take advantage of the methods which enable the participation of children in both research and design processes, in developing studies intended to enable changeability of environments.

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