Play Material in Visual Perception Development

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This article analyzes the impact of play material on the perceptual development. The experimental study was based on the concept of sensory education by A. V. Zaporozhets and A. L. Venger. In addition, to assess the level of visual perception, the structure of visual perception developed by M. Frostig was used. The visual-motor coordination, the figure-background ratio, the constancy and the ability to determine position in space and spatial relationships are considered as the most important characteristics in this system. The comprehensive analysis of changes in the development of play activity was facilitated by the fact that the assessment was carried out according to the following criteria: motivational component, type, orientation, level of play actions. The article describes both the the results of the experiment, conducted in different conditions of pre-school education, as well as the outcomes of play program, aimed at the development of visual perception, which provided data on the varying degrees of changes in perceptual performance after its implementation.

Keywords: toy, play activity, visual perception, perceptual actions, perceptual development, types of orientation, sensory education.

Game being a source of child's development forms the zone of proximal development. According to L. S. Vygotsky, "the zone of proximal development defines the functions which are not mature yet, but are in the process of maturation; these functions can be called the fruits of development". Therefore play activity in early and preschool age forms a logically preferable environment in which the development of children's mental processes can be completely accomplished. [4, 42]

The problem of game material role in the mental development of children has been intensively dwelled upon in the national literature (A. V. Zaporozhets, D. B. Elkonin, A. S. Spivakovskaya, S. L. Spivakovskaya, S. L. Novoselova, E. O. Smirnova etc.). Despite the considerable number of studies on play activity, however, there is still de-

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ficiency of research devoted to the influence of play material type on one or another psychological developmental component.

The perception development occupies a special place in younger and preschool children mental development, and some later educational difficulties of children are connected with the defects and disturbances of that development. This paper analyzes not only the influence of game material on visual perception development based on the concept elaborated by A. V. Zaporozhets and L. A. Venger, but also, above all, the fact that development is carried out by forming and improving individual perceptual actions. Furthermore, M. Frostig's approach has been used to assess the perception development, according to which the developmental levels of each component form certain levels of visual perception.

There has been singled out the following components of visual perception: constancy, position in space and spatial relations.

The experimental study aimed at identifying the influence of game material on perceptional development has been carried out with children who attend kindergartens, where the children's development was provided by "The Model Program of Child Education and Training in Kindergarten" (by M. A. Vasilieva). A group of children, taken as a control one attend a kindergarten where Maria Montessori's method has been applied. This sample selection has been undertaken in order to compare the perceptive development of children in case of a game, most prevalent in the Montessori system, specially oriented at perceptual development. The experiment involves the following three steps: ascertaining, forming and checking-up ones.

There has been suggested that, in the ascertaining experiment the **visual perception** level of the Montessori children groups should be higher as compared with the children educated according to the regular program. We have worked out a children educated according to the regular program. We have worked out a developmental game program aimed at developing visual perception and forming perceptual actions of the experimental group of children. The question has arisen – whether it is possible for children involved in our program which is oriented on assessing perceptual development, to improve their visual perception level up to the level of the control group (in a shorter time). The total study has involved 60 children at the age of 2 or 3.

The evaluation of game-play activity has been carried out on the basis of singling out the following criteria: a motivational component (the research of a child's interest in activity with adults, in toys (playthings), in the process of playing a game by him/herself); a type of orientation, a level of play actions. For the sake of carrying out a diagnostic examination in the course of ascertaining and checking-up experiment there have been used the following two blocks of techniques – "The Early Diagnostic of Infants Mental Development" by E. A. Strebeleva and "The Perceptual Modeling", "The Shapes Box", "The Models" by L. A. Venger.

Ascertaining experiment

The comparative analysis of the experimental and control groups participating in ascertaining experiment (Table 1) has shown statistically significant differences in outcomes between the groups. The characteristic of **the experimental group** was that of the low level of visual perception development which predominated in all the parameters of both two blocks of techniques. Particularly poor results have been observed when performing tasks of visual-motor coordination (VMC), spatial relations (SR) and position in space (PS) were to be solved. The control group has shown a medium-high level of visual perception, with a large percentage of children having reached the high level of constancy (CONST) and figure-background relationship (FB) (in accordance with the standards of this age).

The next stage of the experimental work was that of a forming experiment, which included the implementation of a game program for developing the child's visual perception skills. The game program contains a system of playthings (toys) selected for the development of each visual perception component (visual-motor coordination, constancy, figure-background relationships, position in space, spatial relations) and perceptual actions (identification, equation to the standard (model), perceptual modeling). Certain gameplay material of 7–8 toys (playthings) of similar type but presented in different versions has been selected for each component to avoid stereotyp-

Table1

(A) The level of perceptual actions in experimental and control groups (in %) (L. A. Venger's technique)

Group	Models			Shapes box			Perceptual modeling		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Experimental	64	36	–	60	23	17	97	3	–
Control	33	40	27	13	80	7	40	53	7

(B) The level of visual perception in experimental and control groups (in %)

Group	VMC			CONST			FB			SR			PS		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Experimental	93	7	–	67	17	16	65	35	–	83	10	7	70	20	10
Control	13	40	47	–	10	90	–	20	80	14	33	53	15	26	59

ing actions. In total 60 toys (playthings) have been involved. The game task has been set in such a way that a child had to single out certain objects, their properties and connections; then establish a play relationship in order to achieve the result. Thus, playing with toys (playthings) is to contribute to the development of visual perception. The selection of game-play material in the program has been based on the principle "from the simple to more complex" for each component of visual perception.

Play activities were organized in groups of 7–10 children each. There have been individual desks with toys (playthings) on them, and experimenters has been changing some toys (playthings) for the others with respect to the success of play action, as well as the child's individual preferences concerning what toy to play. The introduction of a regular plaything has always been accompanied by a certain complication. Let us consider the development of play action according the criteria presented above (motivational component, types of orientation, the level of play action).

Motivational Component in the Play-Actions of Children. To motivate children for playing in experimental groups, an adult has been introducing new toys (plaything), in the course of the game showing his/her personal interest in it. For the beginning of play sessions a soft toy has been chosen in order to make it "watch" the children playing. Those colorful plush animals, particularly familiar to children, tended to arrange a special joy of children. However, educational games (the Seguin Boards with images of fruit, farms, villages, forests, geometric shapes with pins, etc.) appeared to be interesting for a child only in the process of playing together with adults. Many children starting to make mistakes during the process of playing a game, did not want to continue the action, refusing and asking for another plaything. In order to support the interest of children in game material the game situation had been occasionally modified by involving some funny cartoon characters in the game. The children were to pick them up/put them back, etc. After the last two sets of the children's playing they would take pleasure in meeting with experi-

menter, asking questions like; “Are we playing today?”, “And which toy is for me?”, indicating the interest in both the toy (plaything) and in working with adults. The general attitude of children has been emotionally positive. Many children asked the experimenters to leave the toys (playthings) in the group in order to “play” with them. If the game task was successfully carried out the children called the adults to show their success to them.

By the middle of the program the signals (after the game material had been complicated) of a strong interest of children in playing have become quiet obvious. Children were full of wish to finish what they had started and to find the most productive way. The children got upset when they could not fulfill the given task. There has been a methodological improvement obtained in the course of playing. The children’s interest tended to decrease in case they failed, which had been caused by a sharp increase in the number of the game material items. The gradual complication has always maintained a child’s interest and caused no rejection. By the end of the play classes the children could call some of the toys/playthings their favorite ones and next time ask for the same toys/playthings to play.

Another criterion elaborated for evaluation the play activity was that of selecting and describing **the types of orientation** in the course of children’s performing play actions. The following types of orientation have been identified: the search tests (trials) at the level of action, including those checking up adequate and inadequate actions (trial-and-error); perceptual tests (the analysis of failure in the search trials (tests) at the level of action, the construction of the method by means of perceptual trials and tests – hand-eye coordination trying matching); reduced action analysis (visual correlation, mental correlation, analysis of efficient solutions of the game tasks).

In the process of organizing the experiment the tendency towards gradual optimization of orientation types and transformation of effective ways to another material have been distinguished. Let us consider the selected types of orientation in greater detail.

The Search Tests at the Level of Action. At the beginning of play classes the children needed some time to study the game material. The toys or play items consisting of elements needed to be put together, were offered to a child being assembled by an adult in advance. While playing with the toys/play items the child, would take it in his/her hands without any regard to their sizes and his/her own success. There has been observed the recurrence of children’s wrong actions (taking one part after another, paying no attention to their characteristics). That had been repeated till there was no part left, however, though the assembled toys/play items did not look like the similar model samples lying in front of the child on the desk or shown to the child before he/she started to play. These distinctions were pointed out to the child by the adult. The child then started to change his/her strategy and try to distinguish those properties of toys to which errors were related (the size of parts, their number and configuration). The child started to be interested in the results correlating his/her actions with the model toy. Acting by means of random selection, the child at first tends to take wrong items, then having removed the unsuitable part, tries to attach (to put in, to insert or to nest, etc.) another one putting it to the same place, and then at last to find the correct one. The child has been doing it until all the elements (or, at last, most of them) are placed in the right way (the adult draws the child’s attention to the correct way of performing the task using for that sake some kind of approval). Then, the child would find the right way of action, which he/she would repeat several times on in succession. The errors in the course of performing the actions can be made by the child repeatedly until he/she starts understanding where the mistakes have been made and how to correct them without other people’s assistance. In any new successful case, the child would repeat his/her actions which could result in an unconscious analysis of the mistakes causes which the child could discover and which the child could correct sometimes on his/her own (or with the help of an adult) and then continue to play. The repetition the actions could help to support the child’s success. While repeating the actions, the child would begin to compare one part of a toy with the other ones learning to select and, thus, rising to another type of orientation.

Perceptual Tests. Considering the defects of the search tests at the level of action, the child before choosing a toy’s part would first try to at-

tach the part to the construction (e.g. the level of action), and then visualize each item (part) to be taken (in order to correct the action).Then the child would compare the chosen part with other items. Mistakes are, nevertheless, still there. The child starts choosing every now item more carefully. Having chosen wrong part of a toy the child would correct his/her actions by means of self-correction. When the child just starts acting on the level of perceptual orientation there can be often observed correlations with the search tests (level of action), but at this new stage the child would no longer need any help in correcting his/her mistakes. The stage of perceptual orientation seems to be long enough and require additional complexity of new play tasks in order to encourage the child to establish a visual correlation. The convenience of combining the visual correlation with the search tests implementation at the level of action would allow the child to solve play tasks successfully without rising to the following (most complicated) level of orientation. The gradual complication of play material is absolutely necessary for a child to rise from this level to the higher one.

Visual Correlation. The child can reach this type of orientation only in case of his/her complete success at the previous stages of orientation and use the acquired skills actively in playing.

Visual correlation allows the child to fulfill the task (for example, to put a fruit on a hedgehog's is back in the game "Lace-a-shape" one has to take into consideration some other figures, as well as to choose the place in the right way.

The following criterion of analyzing play activities was that of measuring the level of the child's performing skills in play activities. The content of play activities tends to differ at the preliminary and main stages. At the preliminary stage non-specific operations used to be worked out, such as the toy's design, the necessity to put the items into the right places, etc.

At the main stage the specific actions have been worked out, which tend to correspond to

Table 2

Changing the types of orientation in play activities of children (30 children altogether)

Skills under development	Play material	Number of children using the type of orientation at the beginning of classes			Number of children using the type of orientation to the end of play activities		
		Trial and Error	Perceptual trials	Viscua l correlation	Trial and Error	Perceptual trials	Viscual correlation
Visual-motor coordination	Lace-a-shape, Nest N'Stack Bowls	26	4			21	9
Figure-background ratio	Modules with buttons	18	12		5	15	10
Constancy	Mailbox	26	4		2	18	10
Spatial position	Slotted pictures	25	5		9	3	18
Spatial relations	Labyrinths and sticks for constructing	25	5		9	15	6
Identification	Lotto of shadows	26	4			12	18
Models	Lotto of shadows	28	2		4	18	8
Perceptual modeling	Slotted pictures	25	5		9	3	18

the play items and their developmental functions. In this case it has become possible to identify a general algorithm of main actions as well as the accompanying actions, when the child is to play, select parts (to analyze, to group), to compare parts (perceptual actions); to select the size, to establish the sequence (considering the size, not missing the next larger part, etc.), to chose and to combine two things with each other; to put items in right places, etc. The accompanying actions are defined in accordance with the peculiarities of the material, which include: stringing (threading), inserting (putting in), pressing, opening/closing, etc.

Let us consider the performance algorithm by using as the example mastering the activities with lace-a-shapes sets.

The children were offered an assembled lace with a hard rod. Every child was to take it into his/her hands and begin to unlace. When the lace was completely untightened, a child tried to pull the rod through the hole. The child was acting at random, not trying to follow some sequences and logics. The actions were of a random nature, some mistakes would occur again and again, and even the correct performance could hardly be recorded as a success and it didn't happen immediately. The difficulty was in the fact that as the child was asked to work with two loose ends of the rope it was not easy for him/her, to hold the beginning and the end of the rope and to hold a free "tail". After a child had succeeded in mastering the laces having then hard end's he/she was offered the laces having soft rods. Thus, the task became more complicated but the child had already got some assimilated preliminary skills. To fulfill the new task the child required more complex visual-motor coordination. The possibility to play slowly had encouraged the child's transition to perceptual orientation. The child first tended to think over which hole the lace was to be pulled through. The success of the child in solving this little problem was fixed encouraging him/her to fulfill the task quicker. Then the children were offered soft laces having soft rods in a form of a hedgehog. These laces were to be pulled through the holes in some toy fruits.

Similar to the case with other play things the laces were offered being preliminary assembled. From the experience of his/her previous activities with the laces the child had already learned to do, so he/she started to thread one object (fruit) on the lace. The difficulty here was that the child was to attach one object on the lace to another one, in which there was also a hole. An experimenter explained that "the apples should be put on the hedgehog's back, so you are to put them there". Initially the child's actions were just the attempts. Although the child had already learned that it was necessary to follow the correct order if he/she was to thread an object on the lace, that fact was not taken into account: he/she found an important thing to do just to thread and attach without any order. When the child finished, a modal of the lace was put in front of him/her. It was just another identical "hedgehog" lace, but there it was easily seen that fruits had been threaded arranged on one side and in a certain order. An adult drew the child's attention to the location of the items and offered the child to try and fulfill the task again. After several play sessions the child started to guess where to place the fruit, thus indicating the improvement of his/her perceptual tests which led to success. If a child had made a mistake while threading, he/she corrected himself quickly.

The next plaything was a lace "a hedgehog with a dotted picture of the fruit location". The presence of the fruit location scheme (a dotted line) stimulated the child to change the type of action orientation in order: not to make mistakes, it was necessary to correlate the dotted places with the holes. First, the children performed the task the same way as in the case of "the hedgehog-lace" where there were no any dotted lines. With the help of an adult the child started to attach a figure, finding the places of the wholes junctions. As soon as the child performed the action correctly, he/she wanted to do it again and again. The child began to repeat his actions, making mistakes again (sometimes several times), coming at last to the right decision. By repeating the performance, the child consolidated good results. While conducting playing, it has been indicated that those toys, which the children managed to assemble with a success, stimulated them stronger than more complicated toys. The need for achieving the goal was identified to become a significant indicator of how good are the results of developmental programs which proved to be true. In the course of playing with such toys there has been observed the change of orientation. When

the child starts taking into account his/her previous success for efforts, his/her performance improves. Anticipation of the following action was performed by children by means of perceptual tests. By the end of playing sessions the child started using visual correlation, having already learnt how to act in the right way making no mistakes. If in the course of experiment the toys were replaced by similar other toys of the same game principle (configuration) then closer to the end of the glasses the child would learn how the slots and the items correlate with each other, and only afterwards start acting. Almost always the child fulfills the task successfully, there were seldom any mistakes, which the child could correct on his/her own.

Check Experiment

After the orientation type had been changed in the course of the developmental play activities a check up experiment was carried out aimed at determining the level of visual perception development as well as the level of perceptual actions. We assumed that there has been an established relationship between the changes in the type of orientation applied in the course of play actions as well as the level of visual perception and perceptual actions.

In the check-up experiment the same technique as in the ascertaining one has been applied. The reliability of the obtained results was estimated according to the Student's t-tests, only differences with the probability of $p<0.05$ being considered reliable.

The comparative analysis of the result of E. A. Strebeleva's technique application in the experimental group before and after the classes has shown that the greatest possible increase could be observed in the levels of visual-motor coordinating (from 0 % to 83 % of high-level). There has been also noted the growing increase in the number of children with high levels of constancy (from 16 % to 70 %), figure background relations (from 0 % to 60 %), spatial relations (up from 7 % to 60 %), the ability to determine the position in the space (from 10 % to 65 %). The comparative analysis of the results of L. A. Venger's technique application has shown that the growing number of children with a high level of orientation was most vividly seen when children were playing "The Box of the Shapes" (from 17 % to 60 %). The analysis of the results of such techniques as "The Perceptual Modeling" and "The Models" application has shown that the number of children with a medium of orientation had increased, whereas the higher level of acquiring perceptual modeling skills had occurred in the experimental group (0 %). The children with an adequate type of orientation (while analyzing the shape of the object the children are guided by the ratio if the whole contour as well as of separate items of the toy which allows them to compare their toys with a model quite accurately) had been observed (0 %).

The results of this experimental study aimed at analyzing the role of game material in visual perception have shown:

1. The game program had had a positive influence on children's visual perception development, especially in there early age because according to the most of indicators there has been a growing number of children with a medium

Table 3

(A) The level of the perceptive actions development and control groups in (in %) (L. A. Venger's technique).

Group	Stages	Models			Shapes Box			Perceptual modeling		
		Low	Medium	High	Low	Medium	High	Low	Medium	High
Experimental	Constr.	64	36	–	60	23	17	97	3	–
	Control	34	66	–	3	37	60	64	36	–
Control	Constr.	33	40	27	13	80	7	40	53	7
	Control	30	43	27	10	75	15	40	53	7

(B) The level of visual perception development in experimental and control groups (in %).

Group	Stages	VMC			CONST			FB			SR			PS		
		Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Experimental	Constr.	93	7	–	67	17	16	65	35	–	83	10	7	70	20	10
	Control	3	14	83	5	25	70	10	30	60	28	12	60	15	20	65
Control	Constr.	13	40	47	–	10	90	–	20	80	14	33	53	15	26	59
	Control	5	25	70	–	10	90	–	14	86	15	20	65	10	20	70

and high level of visual perception. An improvement has been observed in the development of visual-motor coordination, figure-background relationship, constancy, and determining the position in space. After the course of developmental play activities the high level of visual perception has become predominant (according to many indicators). The slowest progress in the development has been observed on the level of spatial relations. The level of identification has risen from the low one to the medium one, the development of perceptual modeling has reached a medium level, though some children would still remain on a low one. There has been a change in the types of orientation: the number of children, performing game tasks by this function of trial-and-error, has reduced due to using visual correlation, perceptual tests and trials – hand-eye coordination.

2. The considerable difference between the outputs of the diagnostic methods of experimental control group in the ascertaining experiment has shown that the perceptual actions have been developing in the course of sensor activities from the very early age. This has been indicated by the data obtained under different conditions of sensory education (an ordinary kindergarten and Montessori group). The control experiment data have shown a great role of toys in sensor development. For the relatively short time of playing with toys requiring the use of perceptual actions, there have occurred certain changes in the level of visual perception. The qualitative changes on the level of visual perception are associated with the development of play activity itself, with the change of orientation guidance in it.

3. The data referred to various degrees of changes in perceptual indicators after the developmental programs implementation is of great interest.

It has been found that no success occurs which helps to develop perceptual modeling up to the high level, although the number of children with middle level had increased from 3% to 36%.

A slight improvement of characteristics of the control group children playing with “Different Pictures” has been observed when the “Perceptual Modeling” technique was applied. On the contrary, no significant improvement has been observed and the high level has not been reached. This corresponds to the results of other studies in the field. Thus, as it was earlier mentioned in the studies of L. V. Morozova, the greatest difficulties tend to arise in the development of such visual perception components having a complex psycho-physiological structure as visual-motor integration, visual perception constancy and visual analysis-synthesis. Visual-special perception and visual-motor integration of visual perception have got the most complex psycho-physiological structure and similar function which explain their effectiveness. They also mention a long maturation phase for the development of above visual perception components in ascending ontogeny. The supposition has been made that it is their structural similarity which explains the simultaneity of their development.

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