International Journal of Education Humanities and Social Science

ISSN: 2582-0745
Vol. 4, No. 01; 2021

EFFECT OF THE MOTOR GAME "9 POINTS SQUARE" ON THE TOPOLOGICAL STRUCTURE OF THE RELATIONAL SPACE IN PRESCHOOL CHILDREN

Anis Ben Chikha
University of Manouba. Higher Institute of Sport and Physical Education (Ksar Saïd). Tunisia
Aymen Hawani
University of Manouba. Higher Institute of Sport and Physical Education (Ksar Saïd). Tunisia

ABSTRACT
The relational structure of the space for the preschool child in order to ensure an efficient interaction with its environment is crucial. The acquisition of a topological and spatial language represents the perspective of this study, in particular based on the action of a game "the 9 points square "created about it. The effects of this game on the topological relationships were studied among child (N=44) of preschool establishment during the school year 2019 - 2020. The average age of the participants 4.1 years. ANOVA model for repeated measures was used for data analysis. Results showed that after the learning program based on the motor game, the children of the experimental group (N=22) significantly improved their topological relationships assessment. In contrary, the children of the control group (N=22) did not showed significant differences between the pre- and the post-measurement.

Key Words: Spatial Relations, Learning program, Motor Game.

1. INTRODUCTION
Contemporary educational organizations propose that children's experiences in sport and physical activity contribute to the mental acuity, skills, and strategies that are important for navigating challenges faced across the life span America (SoHaPE, 2014). In addition for all human functions, the ability to plan and carry out activities covering wide spaces is essential. Spatial skills play a key role in many types of reasoning and communication and are important in domains such as mathematics, natural sciences, and engineering (Head and Isom, 2010). This mapping and planning ability is developed in the first years of life and will affect the organization of the future of the individual (Hazen and Durett, 1982).

Space is the physical, perceptual, conceptual or representative in which real or representedobjects, mobile or immobile, animated ornot animated, are located and moved actively or passively, in a system of spatio-temporal relations(Fayasseand Thibaut, 2003). In a spatio-temporal reference system dimensional and relational aspects of space need to be accurately defined to promote motor cognition and so appropriate behaviour (Wade&Swanston, 2001). Consequently, an essential role of spatial perception is to provide access to information for the organization of the action (Milner and Goodale, 1995).

ISSN: 2582-0745
Vol. 4, No. 01; 2021

For this purpose, whether in motor activities or even in the activities of daily life the child's motor skills require precise knowledge of the position and orientation of the body and objects in the space where he actsIn this study we have chosen to use the game in its functional spatial dimension, to arrive at a rational and efficient structuring of childhood environment.Indeed, the child's actuation in a fun location space exploration would be our interest. A complex situation that he has to find each time the suitable solution tailored to the proposed variables through perceptual mechanisms of space navigation. This capacity is then based on complex mechanisms which, if they do not develop properly, make complicated or impossible processing visuospatial information,that joined what (Paoletti, 1999)defined as motor education. So, there is an approach that emphasizes the use of driving experiences on a daily basis by the child as a key to self-knowledge and a move towards the objective and rational thought. This educational approach is in line with the idea that the driving experience or well-structured games allow children to discover general and disciplinary concepts (Paoletti, 1999).

The spatial references

The perception of the spatial position of objects to which movements are directed can be determined with respect to some or all of our body. To this end, locating the ability points of the body grows together with the ability to use his body to move and to guide.

The concept of a *frame of reference* has is origins in describing spatial coordinates and is still used in physics to describe “a system of coordinate axes in relation to which size, position, or motion can be defined” (Dictionary, 2015)

. The human body is a fundamental axis system in orientation phenomena. It will be noted that the lateral axis (or median) which refers to the symmetrical sides of the body, the front axle will be given by the different functions of the body (the look direction in particular) and the vertical axis (cephalo-caudal) expressed by gravity, which may be detected in a standing position. Different terminology in the literature can thus be used to state the origin of egocentric coding. The egocentric encoding of an object can be retinoids - or eye-centered, cerebro-centered (Karn et al., 1997), trunk-centered (Darling & Miller, 1995), referred to a specific body segment to the task as requested shoulder (Soechting et al., 1990), or referred to the viewing direction. At each of these tasks corresponds an egocentric reference frame withdifferent origin body (Ghafouri et al., 2002).

Egocentric and allocentric are often described as aspects of personality or social behavior. *Egocentrism* uses *ego*, the Latin word for I; in egocentrism that which thinks is the focus of what it thinks about, and the frame it thinks through. The modern conceptualization of egocentrism is attributed to Piaget, who at first drew upon the influence of Freud while doing scholarly work on psychoanalysis (Kesselring and Müller, 2011). Piaget described egocentrism in terms of developmental psychology, as an aspect of an early stage in cognitive development (Piaget, 1936). According to Piaget, young children are egocentric: they ascribe their own feelings and experiences to everyone.

Spatial frameand action

Recollecting spatial locations with respect to one's own position is another important consequence of possessing an egocentric frame of reference, as it allows one to compute distances and directions from the body to objects(Wangand Spelke ,2002; Smyth and Kennedy ,1982)
Moreover, it has been ascertained that the encoding of an egocentric frame of reference, as it largely depends on vision, favors the recovery of locations that are placed in front of the observer with respect to those placed at her/his back(Montello et al.,1999)
This strong reliance upon a view-based spatial frame does not prevent from creating and operating on external, orientation-independent frames of reference. However, these are more the exception than the rule: as soon as visual information permits recognition of the spatial arrangement as originally encoded in a learned view, self-centered representations prevail
This framework allows considering treatment of spatial information is also based on internal knowledge: representations of the body and the body's capacity for action. Computation approaches to motor intentional indeed postulate that the movement and its effects on the environment would be decisive for the structuring of sensory-motor invariants. The co-occurrence of motor and sensory signals during motor production would indeed build internal representations of expected sensory consequences of intentional acts engines (Mossio and Taraborelli, 2008). This knowledge allows later to give a motor direction or a driving intention to intentional motor acts observed (Bidet-Ildéi et al., 2011). This sensory-motor knowledge would also perceive the space in relation to the organization of potentials actions.

Motor game

Interest in the use of educational games in an initial learning context is crucial. Studies by (Jones, 1998; Baranowski et al., 2003) show that games provide favorable conditions for learning, including feedback, the interaction and active participation of learners.Child benefit from movement experiences in physical activities. If designed well, movement provides a social avenue in psychomotor, cognitive, and affective learning. For this purpose physical activities uses game to reach this goal through pedagogy that highlights the possibilities for learning by movement. Education professionals and child development agree that the game provides the child with movement experiences, creativity, and friendship in a way that emphasizes fun (Lester and Russell, 2010). In addition, Ginsburg (2007) points out that the game is considered as a great way to increase the level of motor activities for children, and that is the joy of childhood.

In accordance with the theoretical basis presented above we have developed a quasi-experimental research to explore the effect of a playful driving education program designed for the development of thematic concepts related to topological representations on preschool children.

2. METHOD

This study is about a motor game that we created and called “the 9 points square“. It aimed the child's motor learning taking into account internal and external factors that influence the

ISSN: 2582-0745
Vol. 4, No. 01; 2021

acquisition of actions and spatial displacements representations, programming, organizing trips, place and time, retroactive and proactive feedback, attention and memory .Certainly, these skills could support following a transfer of learning, the development of transversal skills useful in other preschool learning.

The game is a square with 9 points traced, on the floor in a preschool playground institution, the side of the square measures 6 meters.This game would mainly target the spatial organization through actuating the children's ability to be in the area to determine the position one occupies in relation to benchmarks and a coordinate system and matching correctly different movements for different topological possible relations and described by the various proposed variants. Spatial orientation is associated with the perception and spatial structure is associated with abstraction and reasoning.

Participants

Theaverage age of the participants (N=44) is 4.1 years. These children are schooled in both mixed preschool classes each one containing twenty two children. Their middle parent socio-cultural level is defined by the father's job. All these participants are considered normal and well-adjusted to preschool institution. Their parents were informed and give their agreement signature about the participation of their children in the experiment research and they have the opportunity at any time to withdraw their children from it. The results of this research guarantee anonymity and confidentiality and the parents may be aware of their children's skills assessment.

Procedure

This study is therefore divided into three parts. First, we conducted a pre-test on the two groups of children to verify the homogeneity through a test assessing their topological relationships. Secondly, and for 10 weeks, with three sessions of 30 minutes / week, we submitted on one hand, the experimental grouplearningwith a programbased on the game “the 9 points square” and on the other, the control group with a conventional learning. The third and final section is devoted to a re-test evaluating the topological relations of the two groups of students.

The test donefor the children to assess the topological relationships is: RTD (Topological and Directional Relation Test byLacert (2010). In fact, for the test,the child is interviewed individually in a room of his preschoolinstitution in which he is sitting comfortably at a table facing the examiner. The child should then follow a presentation by 9 points initially listed on a sheet "refer" which is laid flat on the table and oriented in portrait, try to recognize the place of a single item on a separate sheet "stimulus". After passing reference to right over, the examiner inverts reference sheet and stimulus leaves and starts executing it, refer to the left.

3 types of responses are recorded:
- Correct answer
- Mirroring answer: the child shows the symmetrical point to the expected relative to a vertical axis passing through the centre of the sheet.
- Error: any response not corresponding to a right answer or a mirror.

The correctanswer is separated from the total number of errors and the number of mirrors depending on the side of the sheet "referent" so it has 4 results, two for the referent right (total errors and total mirrors) and two for the referent left (total errors and total mirrors). Using the calibration tables, the corrector converts the raw results in cumulative percentages to compare the results of the participant with those of children in the same age. Having collected the data obtained, we subject them to analysis of variance (ANOVA).

3. DATA ANALYSIS

For each measurements taken before and after training, ANOVA was performed with the factor "type of learning" (motor game learning and traditional learning) as a variable factor *inter* and "period" (pre-test and post-test) as a variable *intra*.The factorial model was 2x2 (2 groups x 2 measurements). Post-hoc comparisons were made with the Sidak test and the level of significance was set at α=.05.

4. RESULTS

Table 1: Means and standard deviations of the parameters of the study before and after training for both groups.

amètres	**trol group (N = 22)**			**érimental groupe (N = 22)**		
	ore	**r**	**%)**	**ore**	**r**	**%)**
Number of mirro	±1,26	±1,18	(3,40%)	±1,26	±1,05***###	(67,84%)###
Number of mirror	±1,58	±1,49	(5,72%)	±1,29	±0,59***###	(82,62%)###
Number of errors	,02	±0,89	(14%)	,11	±0,47**##	(86,%) ###
Number of errors	±1,01	±0,77	(34,14%)	±1,04	±0,21**	(92,64%)#
% cumulative m	8±26,24	2±26,28	4 (-0,72%)	4±7,37	5±41,69***##	91 (-336,58%)###
% cumulative m	9±31,77	5±31,68	6 (-2,42%)	2±28,9	6±26,05***##	54 (-128,93%)###
% cumulative e	1±26,64	2±47,03	1 (-10,77%)	6±47,05	5±27,38***##	69 (-104,07%)###
% cumulative err	7±42,91	7±34,09	(-5,46%)	4±47,84	7±19,83**	63 (-56,64%)#

Source: Own elaboration
** Significant difference compared to the prior learning p <0.05; ** P <0.01; *** P <0.001.*
#significantly different from the control group at p <0.05; ## P <0.01; ### P <0.001.

The results shown in Table 1 indicate that the two groups were homogeneous for all parameters (no significant difference between the two groups before learning).In addition, the experimental group shows significant differences between the before and after training and for all tested parameters. Furthermore, significant differences were recorded between the control group and the experimental group at the after training (except the number of errors on left and%

Cumulative errors on left). Moreover, the table 1 specify that the progress (Δ = before - After) recorded by the experimental group is significantly different from the control group at all settings (except the number of errors on leftand% Cumulative errors on left). The data obtained in the test assessment are analysed among the answers of the participants.

Number of mirrors on the right

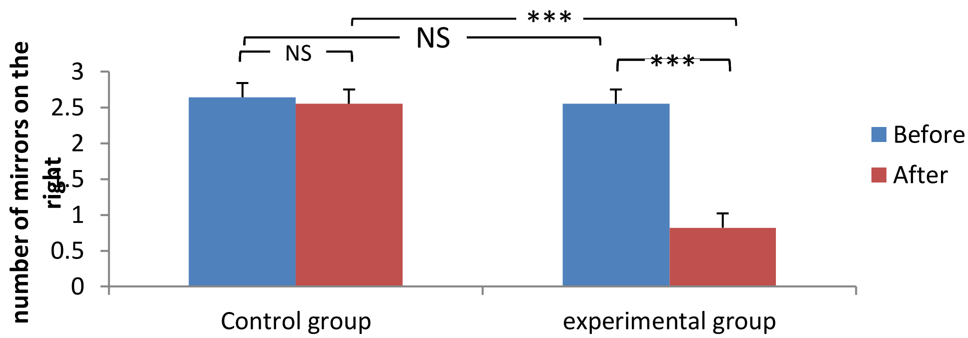

Figure 1: Number of mirrors on the right before and after learning among both groups.
*NS: not significant (p> 0.05); *** significantly different at p <0.001.*
As regarding the number of mirrors on the right in the results of the test assessment, Figure 1 showed on one hand, a significant group effect [F (1, 42) = 8.19; p = 0.006< 0.01]; η2 = 0.109 and on the other one, a significant learning effect [F(1,42) = 24.29; p =0.0000133< 0.001]; η2 = 0.379. However, group learning interactionis significant [F(1,42) = 23.70; p =0.000016< 0.001]; η2 = 0.286.

Number of mirrors on the left

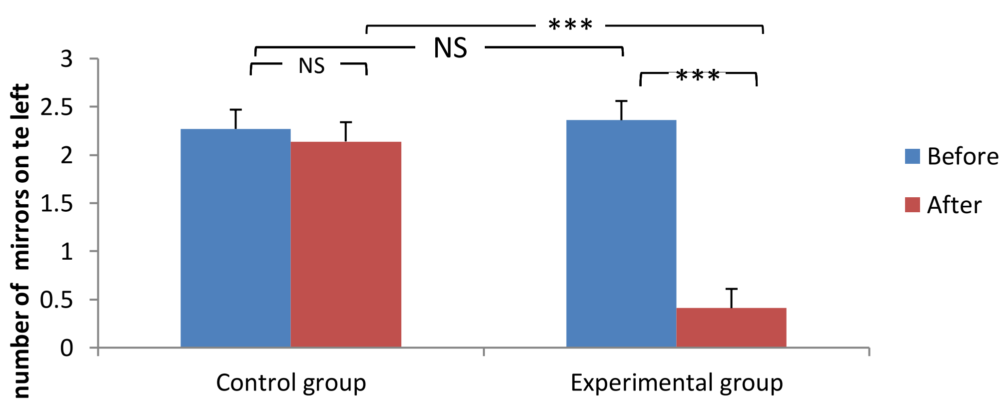

Figure 2: Number of mirrors on the left before and after learning the control group and the experimental group**.**

*NS: not significant (p> 0.05); *** significantly different at p <0.001*

ISSN: 2582-0745
Vol. 4, No. 01; 2021

As shown in Figure 2 a significant group effect is noted [F (1, 42) = 5.08 ; p = 0.02<0.05]; η2 = 0.096 concerning the number of mirrors on the left and also a significant learning effect too [F (1, 42) = 41.61 ; p= 0.000000089<0.001]; η2 = 0.28. As well as, an group learning interaction is significant [$F_{(1\ ;\ 42)}$ =38.62 ; p=0.0000001 <0.001]; η2 = 0.18.

Number of errors on the right

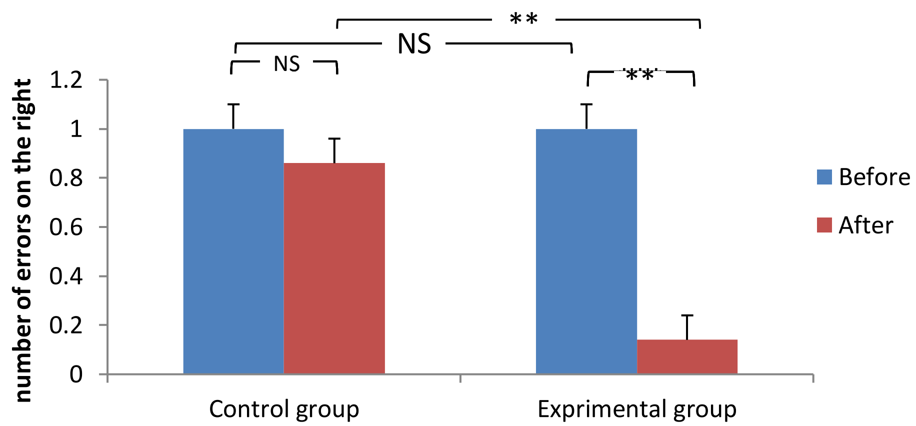

Figure 3: Number of errors on the right before and after learning the control group and the experimental group.

*NS: not significant (p> 0.05); ** Significant difference at p <0.01; *** P <0.001*

As regarding the number of errors on the right, the figure 3 although it showed a non-significant group effect [F (1, 42) = 2.08 ; p=0.15 >0.05]; η2 = 0.044, it presented a significant learning effect [F (1, 42) = 11.26 ; P=0.0016<0.01]; η2 = 0.297 and a significant group learning interaction [F (1, 42) =11.53 ; p=0.0015 <0.01]; η2 = 0.188.

Number of errors on the left

ISSN: 2582-0745
Vol. 4, No. 01; 2021

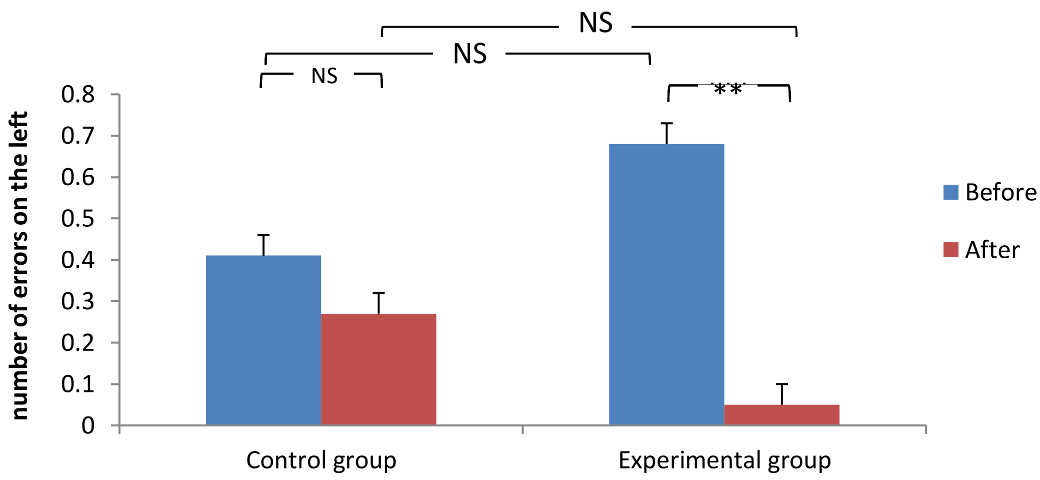

Figure 4: Number of errors on the left before and after learning the control group and the experimental group**.**

*NS: not significant (p> 0.05); ** Significant difference at p <0.01*

As regarding the number of errors on the left in the results of the test assessment, Figure 4 showed a non-significant group effect [F (1, 42) =0.01 ; p=0.91 >0.05]; η2 = 0, but a significant learning effect [F (1, 42) =7.88 ; P=0.007 <0.01]; η2 = 0.176 and an insignificant group learning interaction [F (1, 42) =4.17 ;p=0.047<0.05]; η2 = 0.087.

Cumulative percentage mirrors on the right

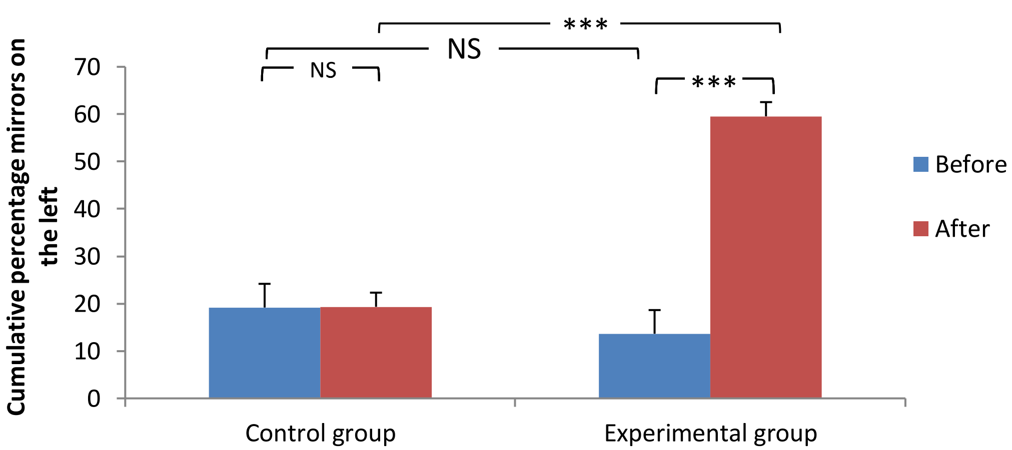

Figure 5: Cumulative percentage mirrors on the right before and after learning the control group and the experimental group**.**

ISSN: 2582-0745
Vol. 4, No. 01; 2021

*NS: not significant (p> 0.05); *** significantly different at p <0.001*

As shown as in the figure 5, the percentage cumulative mirrors on the right present a significant Group effect [F (1, 42) = =5.43 ; p=0.02 < 0.05]; η2 = 0.199. Also, a significant learning effect [F (1, 42) =25.87 ; P = 0.0000000803 < 0.001]; η2 = 0.349 and a significant group learning interaction [F (1, 42) =29.53 ; p=0.0000025 <0.001]; η2 = 0.342.

Cumulative percentage mirrors on the left.

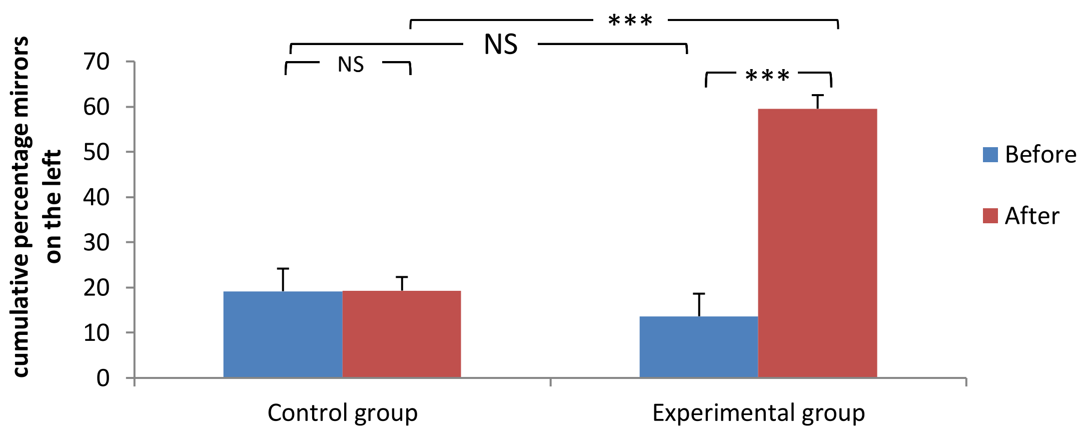

Figure 6: Cumulative Percentage mirrors on the left before and after learning the control group and the experimental group.

*NS: not significant (p> 0.05); *** significantly different at p <0.001.*

As shown in Figure 6 a significant group effect is noted [F (1, 42) =4.75 ; p=0.03 <0.05]; η2 = 0.12 for the percentage cumulative mirrors left, in addition of a significant learning effect [F (1, 42) =30.15 ; P=0.00000213 <0.001]; η2 = 0.34 and a significant group learning interaction [F (1, 42) = =39.27 ; p=0,00000016 < 0,001]; η2 = 0.333.

Cumulative errors percentage on the right

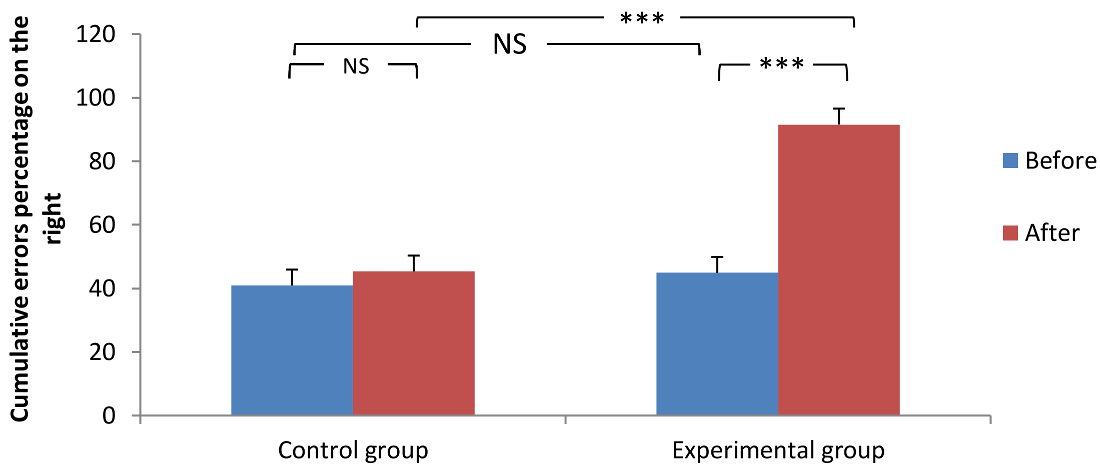

Figure 7: Cumulative errors percentage on the right before and after learning the control group and the experimental group

*NS: not significant (p> 0.05); *** significantly different at p <0.001.*

Regarding the cumulative errors percentage on the right, the figure 7 showed a significant group effect [F (1, 42) = 4.67 ; p=0.03 <0.05]; η2 = 0.102. It presented, furthermore, a significant learning effect [F (1, 42) =16.17 ; P=0.00023 < 0.001]; η2 = 0.34 and a significant group learning interaction [F (1, 42) = =20.96 ; p=0.00041 < 0.001]; η2 = 0.264.

Cumulative errors percentage on the left

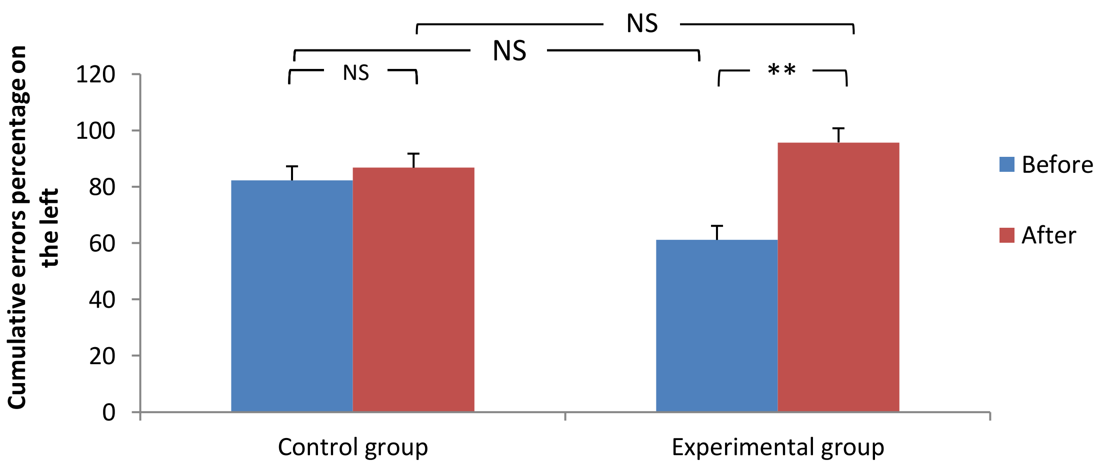

Figure 8: Cumulative errors percentage on the left before and after learning the control group and the experimental group**.**

*NS: not significant (p> 0.05); ** Significant difference at p <0.01*

Figure 8 announced a non-significant effect group [F (1, 42)=0.44 ; p=0.507 >0,05]; η2 = 0.017 concerning the cumulative percentage of errors in the left. Nevertheless it revealed a significant learning effect [F (1, 42) =9.84 ; P=0.0031 < 0.01]; η2 = 0.151, contrary the group learning interaction is insignificantly shown [F (1, 42) =5.84 ; p=0.02 <0.05]; η2 = 0.043.

4. DISCUSSION AND CONCLUSION

This study aims to assess the effects of usinga motor education program based on the game and seeking exploration and location of the space from predefined benchmarks on topological skills in preschool children.in fact, Early childhood is considered one of the most critical and intensive periods of brain development throughout the human lifespan (Khan and Hillman, 2014) . Also, consistent with many studies, moving is a motor and sensory experience in connection with the memory, for understanding the spatial environment organization. (Bidet-Ildéi ,Orliaguet&Coello, 2011). To be represented, the space must be experienced as moving in us, we simultaneously change our perception of the environment.

The results of the study show that children mainly in the experimental group performed better than those who followed a traditional learning. In fact, we found that the learning effect is significant and at all levels of the test (number and percentage cumulative mirrors and errors right and left).

"The 9 points" offersforthe child the opportunity to navigate in the game space while seeking his sensory-motor system based in particular on building repositories and egocentric allocentrics that working together or separately, conduct ongoing updating of its own "mapping" extracorporeal and directional competence (left –right). The purpose of these systems is to allow the taking of benchmarks and the construction of a "space of places" in which objects are identified and located as the target of the action (Paillard, 1991).

However, the game changes the zone of proximal development. Apprentice ships located in this area are oriented towards a level of cognitive development processes that the child has not yet acquired, but which becomes accessible with a pair support, a parent or a teacher. Thus, among Vygotsky,learning by the game is a good learning because it precedes the development (Rivière, 1990)

Limitations

The research findings, although of a limited validity and generalization due to the small size of the sample, showed that motor game “9 points square” can play an important role in the learning of fundamental concepts relating to the topological structure of the relational space and which are also offered for cross thematic and interdisciplinary teaching in preschool learning activities .

Declaration of conflicting interests

No potential of interest conflict has been reported by the authors.

REFERENCES

America SoHaPE. National standards & grade-level outcomes for K-12 physical education. Champaign, IL: Human Kinetics; 2014.

Bidet-Ildei, C., Orliaguet, J.P., &Coello, Y. (2011).Role of motor representations in the identification of human movement.*Psychological year*, 111, 409-445.

Hazen, N., & Durett, M. E. (1982) Relationship of security of attachment to exploration and cognitive mapping abilities in 2-year-olds. Developmental Psychology, 18, 751-759.

Head, D., & Isom, M. (2010)Age effects on wayfinding and route learning skills. Behavioral Brain Research, 209, 49-58.

Wang RF, Spelke ES. Human spatial representation: insights from animals. Trends Cogn Sci 2002, 6:376–382.

Montello DR, Richardson AE, Hegarty M, Provenza M. A comparison of methods for estimating directions in egocentric space. Perception 1999, 28:981–1000.

Paillard, J. (1991).*Motor and representational framing of space.*Brain and space. Oxford : Oxford University Press. 163-182.

Piaget, J. (1936). *Origins of Intelligence in the Child.* London: Routledge & Kegan Paul.

Smyth MM, Kennedy JE. Orientation and spatial representation within multiple frames of reference. Br J Psychol 1982, 73:527–535.

Khan N. A., Hillman C. H. The relation of childhood physical activity and aerobic fitness to brain function and cognition: a review. *Pediatric exercise science*. 2014;26(2):138–146. doi: 10.1123/pes.2013-0125.

Kesselring, T., and Müller, U. (2011). The concept of egocentrism in the context of Piaget's theory. *New Ideas Psychol.* 29, 327–345. doi: 10.1016/j.newideapsych.2010.03.008

Rivière, A. (1990).*The psychology Vygotsky*, Liège, Pierre Mardaga.