

A descriptive study on the child spatial representation (08 to 12 years old)

دراسة وصفية لتطور التمثيل الفضائي لدى الطفل (من عمر 8 الى 12 سنة)

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Abstract:

This study aims at identifying the phases of spatial representation development for children. The sample includes 60 children of 08 to 12 years old with no impairments. The informants are divided into 03 equal groups according to age. To achieve the study objectives, we used two spatial tests; the Three Mountains Test and Size Storing Test. Findings show that when representing the space, children go through the same phases mentioned by Piaget in his studies; but in different ages. Besides, the sociocultural environment affects the age phases of the spatial representation of children.

Keywords: spatial representation; topological space; projective space; Euclidean space; the sociocultural environment.

ملخص:

تهدف الدراسة الحالية الى معرفة مراحل تطور التمثيل الفضائي لدى الطفل. تكونت عينة الدراسة من 60 طفل تتراوح اعمارهم ما بين 8 الى 12 سنة لا يعانون من أي اعاقاة مصاحبة (ذهنية او حسية)، تم تقسيم افراد العينة الى ثلاثة مجموعات متساوية حسب السن. ومن أجل تحقيق هدف الدراسة طبقت الباحثة اختبارين فضائيين: اختبار الجبال الثلاثة و اختبار تقطيع الاحجام. توصلت نتائج الدراسة الى ان أفراد العينة عند تمثيلهم للفضاء يمرون بنفس المراحل التي أشار إليها Piaget في بحوثه لكن يختلف سن ظهور هذه المراحل ، كما توصلت النتائج الى ان البيئة الثقافية والاجتماعية تؤثر على المراحل العمرية لتطور التمثيل الفضائي عند الطفل .

الكلمات المفتاحية: التمثيل الفضائي، الفضاء الطوبولوجي، الفضاء الاسقاطي، الفضاء الاقليدي، البيئة الثقافية والاجتماعية .

Introduction:

The spatial representation is one of the pivotal topics in cognitive psychology and development. It refers to the ability of children to understand the spatial and geometric relations and mentally represent them, mainly in the average and late childhood (08-12 years old). This representation develops through successive phases, from simple topological concepts to the most complicated projective and Euclidean ones, and is influenced by the surrounding environmental and cultural factors. The importance of this concept lies within its direct effect on the academic achievement in math, sciences, and art, and in its role in developing the higher mental abilities and abstract thinking. Thus, this study aims at monitoring and analyzing the development of the spatial representation for children between 08 and 12 years old to achieve a better understanding that helps educators design efficient educational programs and detect the related learning difficulties at an early age.

1. Problematic:

Spatial representation constitutes one of the central concerns in cognitive and developmental psychology, given its foundational role in how children perceive, organise, and interact with the world around them. It refers to the capacity to understand spatial relations, mentally manipulate images, and conceptualise objects in varying positions and orientations, a capacity that manifests across a wide range of mental and cognitive abilities including the visual perception of both flat and three-dimensional objects in motion. The importance of this capacity is not confined to perceptual tasks; it equally underpins academic achievement across disciplines such as mathematics, geometry, science, and technical drawing. Defining spatial representation has occupied several theoretical traditions. Not (1986) describes it as the relative organisation and ordering of material elements within a given space, structured according to distances, directions, sizes, and shapes. From this perspective spatial representation is not a fixed attribute but a dynamic cognitive construction that develops progressively throughout childhood.

Jean Piaget's constructivist theory provides the most elaborated and influential account of this development. Piaget conceived of space as a mental structure through which the child organises the relations between objects and elements in the surrounding environment, and proposed a sequential developmental model in which the child progresses through qualitatively distinct phases. In the initial phase, cognition is anchored in direct, concrete relations between objects what

Piaget termed topological basic relations and is sustained by sensory-motor activity; With the gradual emergence of the symbolic function, the child becomes capable of ordering objects within a projective and subsequently a Euclidean spatial framework (Laurendeau & Pinard, 1986). Piaget further demonstrated that the child transitions from a real, sensory-motor space to a genuinely representational one a transition that unfolds in two broad stages: first, a perceptual stage dominated by topological relations, and second, a representational stage grounded in symbolic activity and the internalisation of action (Piaget & Inhelder, 1972). This progression reflects a fundamental shift from subjective, egocentric knowledge toward a more objective and decentred understanding of spatial reality (Laurendeau & Pinard, 1996). Reuchlin (1977) complements this account by emphasising the role of higher cognitive processes particularly reasoning and abstraction in enabling the transition from simple direct representation to the complex abstraction required by Euclidean space. He underscores that space formation demands not only biological maturation but progressive cognitive organisation: initially, space is practical and confined to the immediate loci of the child's activity; over time, the child comes to situate himself as a mobile entity within a broader coordinated spatial field, such that his movements become relationally defined with respect to those of other objects and persons. The acquisition of semiotic functions is therefore a necessary condition for the representational dimension of spatial development.

Contemporary research has significantly enriched this classical framework by identifying the neural, environmental, and sociocultural mechanisms that mediate spatial development in childhood. Johnson et al. (2023) demonstrated that spatial abilities begin to emerge as early as age three, with a marked developmental acceleration occurring between five and six years of age, and linked this trajectory to both neurological maturation and the quality of environmental stimulation. At the neurological level, Chang and Smith (2022) identified the cortical and subcortical regions involved in the processing of spatial information and traced their differential maturation across childhood findings that are directly relevant for the design of targeted educational and remedial programmes. In the specific domain of mental rotation, Zhang et al. (2023) found that children between the ages of seven and nine display the most significant developmental gains, and recommended that this critical period be accompanied by appropriately designed spatial reasoning activities. Martinez-Garcia and Wilson (2024) further demonstrated the pivotal contribution of play both structured and free to the acquisition of spatial skills, particularly those

involving size discrimination, shape recognition, and directional reasoning. Collectively, these studies establish that spatial development is shaped by a constellation of maturational, environmental, and cultural factors, and that significant individual differences exist among children in the pace and profile of spatial skill acquisition. These findings extend and complement the Piagetian framework rather than contradict it, situating the universal cognitive sequence within a richer matrix of moderating variables.

This sociocultural dimension of spatial development is particularly pertinent to the present study. Although Piaget insisted on the universality of his developmental sequence, he was careful to distinguish from the outset between factors governing the child's autogenous development and those tied to the sociocultural context (Piaget, 1966, p. 4). Cross-cultural research has since confirmed that while the sequential order of developmental stages tends to be preserved across cultures, the pace of acquisition and the specific profile of spatial competencies can vary substantially. Dasen (1977) found that Baoulé children in Ivory Coast replicated the structure and sequence of Piaget's sensory-motor substages, but differed from Western children in the manner of their interaction with the material environment indicating that cultural practices modulate the expression of spatial competencies even when the underlying cognitive sequence is preserved (Kherif, 2008, p. 40). Peluffo (2002), comparing urban and indigenous children in Argentina on classification tasks, similarly found that cultural background significantly shapes the organisation of cognitive activity and cannot be dissociated from its social context. Within the Algerian context, Dergini (2006) directly examined the relationship between spatial structure and living milieu in a sample of 178 children under the age of six, matched on mental ability but drawn from contrasting sociocultural contexts, and confirmed that the sociocultural environment exerts a significant influence on the trajectory of the child's spatial development. More recently, Al-Yoshida (2023) demonstrated in a comparative study between Japanese and American children that cultural practices encouraging early autonomous navigation significantly enhance spatial directional competencies, while Chen and Liu (2021) found that rural Chinese children outperformed urban peers on natural spatial orientation, whereas the latter showed advantages in abstract spatial representation a finding that highlights how specific environmental affordances selectively cultivate distinct spatial abilities.

Building on this body of theoretical and empirical work, and informed by field observations conducted in Algerian primary school settings where recurring difficulties in coordinating spatial dimensions were noted among pupils in the third, fourth, and fifth grades, particularly during craft and technical drawing activities, the present study sets out to examine the spatial representation of Algerian children from a developmental cognitive perspective. This examination is guided by two central research questions:

- Does the Algerian child progress through the same phases of spatial representation identified by Piaget's constructivist theory?
- Does the Algerian sociocultural environment modulate the pace or nature of spatial representation development in ways that diverge from the universal Piagetian trajectory?

Two corresponding hypotheses are advanced: first, that the Algerian child progresses through the same phases of spatial representation identified by Piaget, though at a comparatively later developmental age; and second, that the Algerian sociocultural environment exerts a significant influence on the pace and characteristics of spatial representation development.

2. Aims of the Study:

- To identify and describe the phases of spatial representation development in Algerian children aged 8 to 12 years.
- To examine the manifestations of spatial representation across the developmental phases outlined in Piaget's constructivist theory, with particular attention to topological, projective, and Euclidean spatial competencies.
- To assess the extent to which the Algerian sociocultural environment influences the developmental trajectory of spatial representation in this age group.

3. Significance of the Study:

The present study holds both theoretical and applied significance. Theoretically, it contributes to the cross-cultural validation of Piaget's constructivist account of spatial development by testing its applicability within a non-Western, North African context a population that remains underrepresented in the developmental psychology literature. In doing so, it enriches the existing scientific knowledge base and opens avenues for more in-depth investigations

into the specific factors that mediate spatial development in the Algerian sociocultural context, at a time when educational goals and environmental demands are rapidly evolving.

From an applied standpoint, the findings are directly relevant to educational practice. Spatial representation is a foundational cognitive capacity that supports achievement across multiple academic domains. A clearer understanding of how this capacity develops in Algerian children, and of the sociocultural variables that modulate it can meaningfully inform the design of more contextually sensitive curricula, pedagogical strategies, and early educational intervention programmes.

4. Definition of Study Terms:

4.1 The concept of space:

The Larousse Dictionary defines space as a cognitive, physical, perceptual, or conceptual frame that situates real, perceptual, moving, static, living, or non-living bodies within a system of temporal and spatial relations (Bloch & Coll, 1993, p. 281). From a Piagetian perspective, space is understood not as a pre-given container but as a system of relations through which the child actively constructs objects and perceives their organisation, a progressively built mental framework arising from the child's interaction with the environment (Laurmonier, 2007, p. 3).

4.2 Topological Space:

Topological space is constituted by the internal spatial relations of an object or its mental image, independently of its metric or projective properties. These primary relations – proximity, separation, order, enclosure, and continuity – are grounded in the child's bodily and sensory-motor activity and represent the earliest form of spatial organisation to emerge in development. According to Piaget, topological relations form the necessary foundation upon which more advanced projective and Euclidean spatial structures are subsequently built (Laurendeau & Pinard, 1986).

4.3 Projective Space :

Reuchlin (1977) describes projective space as an extension of topological space that requires the capacity to coordinate spatial relations and forms across multiple viewpoints. The defining developmental achievement of this stage is the child's ability to free himself from a fixed, egocentric referential point when

evaluating spatial relations, and to adopt and coordinate perspectives other than his own. This stage thus marks a decisive advance in spatial decentration, the capacity to represent how a spatial scene appears from a position other than one's own.

4.4 Euclidean Space :

Euclidean space represents the most advanced form of spatial organisation in Piaget's developmental sequence. Reuchlin (1978, pp. 132–136) defines it as the capacity to understand abstract geometrical relations and the properties of spatial figures within a unified, metric referential system that integrates distances, measurements, and angular relations. This system provides the child with a stable geometrical framework enabling the exact coordination of objects in space and the flexible transformation of spatial relations across different perspectives marking the culmination of spatial development within the concrete-operational period.

5. The field study:

5.1 Method of the study:

Due to the nature of the topic, we used the descriptive method that aims at describing the different events and phenomena, collecting information, data, and observations, describing their circumstances, and reporting their real state (Bouhafs, 2010, p. 56).

5.2 The study location:

The study was conducted at Mohamed Guettache Primary School in Baba Hssen (Hay al-Khir), Algiers.

5.3 The study sample:

To achieve the study goals, we chose a sample of 60 children, whom we divided into three groups of equal ages, as follows:

1. 3rd grade group: It includes 20 students between 08 years and 05 months and 09 years and 02 months.
2. 4th grade group: It includes 20 students between 09 years and 04 months and 10 years and 03 months.
3. 5th grade group: It includes 20 students between 10 years and 05 months and 12 years.

The participants were selected based on the following criteria:

Gender: The sample includes males and females.

Age: They are aged between 08 and 12.

Intelligence: We applied the test of drawing a man to make sure the informants do not suffer low intelligence.

Absence of impairments: We checked the medical files and talked with the school doctor and psychologist to find out if the informants show any psychological, sensory, or motor issues.

The socioeconomic level: The informants come from average socioeconomic backgrounds, as we considered the profession and educational background of the parents when selecting them.

5.4 The study tools:

We used two tests that measure the spatial relations, namely:

5.4.1 Size Sorting Test:

This test includes a set of wooden shapes with a red interior (two cylinders, two cubes, and three cones). In each shape, the cross-section plane is indicated by a pencil mark. The examiner presents the shape to the child and explains that it is made of wood, with a white exterior and a red interior. The examiner further explains that if the cylinder is divided into two pieces, the interior appears red. The child is then asked to draw the internal cross-section they would expect to see.

5.4.2 The Three Mountains Task

This test focuses on the projective concepts and the coordination of dimensions (behind, in front of, on the left, and on the right) in a direct way. In addition, it focuses on the projective space and requires the child to combine his projective and coordination systems. The examiner uses a green square wooden model (52 cm per each side). The model has 03 mountains on it; one is big and red, the 2nd is average and blue, and the last is small and yellow. Besides, there is a doll of 03 cm which moves between the mountains and stops at some places from one time to another to take pictures. Moreover, the test has 09 pictures showing different positions of the mountains; two pictures (H-1) are insignificant compared to the position of the advanced mountains. The examiner shows the child the doll and tells him that it is wandering around the mountains

and stops from one time to another to take pictures. Then, he shows a set of pictures that represent the different potential horizons of the mountains, and puts the doll in a position and asks the child to choose the suitable picture of the horizon seen by the doll from its position.

6. Presentation and analysis of the study results:

6.1 Presentation and analysis of the results of group 01 (03rd grade):

6.1.1 Presentation and analysis of the Three Mountains Task

Table 01: Results of Phases 1 and 2 of the Three Mountains Task for Group 01

Results Test phases	Max	Min	Success rate
Phase one (B-C-F)	6	2	66.66%
Phase two (I-E-B-F-C)	7	4	55.5%

The table reveals no substantial differences among participants, with a success rate of 66.66% in Phase 1. The maximum score of 6/6 was achieved by two children, while the minimum of 2/6 was obtained by one child. During the test, some children were unable to coordinate spatial dimensions (behind/in front of, left/right). While some correctly answered Question 1, they failed on Questions 2 and 3. Most children responded correctly to Question F but failed on Question C, instead selecting Card E, which preserves left–right relations. In Question B, after the model was rotated, some children requested that the model be returned to its original position, resulting in incorrect answers. These errors reflect an over-reliance on topological links as a support strategy, while neglecting the projective links that are essential to this task.

In Phase 2, the maximum score was 7/10, the minimum was 4/10, and the success rate was 55.5%. Children were asked to place the doll in the appropriate position consistent with the given card. All children failed Question I, while responses to Questions C, F, B, and E were mixed. Some children placed the doll in the correct position but were unable to provide justification. In general, the nature of the difficulties varied across phases and questions. Topological links alone are insufficient for correct performance; projective and Euclidean relations are required for the precise identification of spatial positions. These results indicate that the children in this group have not yet fully developed projective and Euclidean spatial reasoning — contrary to Piaget's view that

children should be capable of responding correctly to this test from the age of 7. This discrepancy may be attributable to the sociocultural environment, which may not have provided adequate opportunities for the acquisition of such concepts.

6.1.2 Presentation and analysis of Size Sorting Test:

Table 02: Results of the Size Storing Test for group 01

Results Test phases	Min	Max	Success rate
Square shape	0	2	78%
Rectangular shape	0	2	
Circular shape	–	2	
Hollow shape	0	2	
Triangular shape	–	2	

The results show that most of the informants in this group answered correctly, as the maximum score is 10 and the minimum is 06. In the first item (dividing a cube into a square), all the answers were correct, except 03. In item 04 (dividing a cone into hollow shapes), we had only 04 correct answers. The answers were all correct in item 03 (dividing cone into circles) and the last one (dividing cone into triangles). As for item 02, (dividing cube into rectangles), we had only 06 correct answers because the shape is complicated. Thus, we can say that the informants in this group used their projective and Euclidean concepts to succeed in the test.

6.2 Presentation and analysis of the results of group 02 (04th grade):

6.2.1 Presentation and analysis of the Three Mountains Task

Table 03: Results of phases 01 and 02 of the Three Mountains Test for group 02

Results Test phases	Min	Max	Success rate
Phase one (B-C-F)	4	6	82.53%
Phase two (I-E-B-F-C)	5	8	67%

The table indicates that Group 2 achieved higher scores, with a success rate of 82.53% in Phase 1 and a maximum score of 6/6. All students correctly answered Questions F and C; however, responses to Question B were mixed. Following rotation of the model, some participants experienced difficulty selecting the correct card and reverted to answering from their own perspective. This situation requires awareness of projective links, as topological ones are insufficient. Participants in this group thus made effective use of topological links and demonstrated effort in applying projective relations, despite difficulties in coordinating the dimensions in front of/behind and left/right.

In Phase 2, the maximum score was 8/10, the minimum was 5/10, and the success rate was 67%. Participants identified correct positions in most questions, albeit after extended deliberation. They continuously adjusted distances, demonstrating a developing mastery of Euclidean space. Most participants did not answer Question I, responding instead with "I don't know." Overall, despite difficulties encountered in each phase, participants made notable efforts to arrive at correct answers, relying primarily on topological links while attempting to incorporate projective and Euclidean ones.

6.2.2 Presentation and analysis of Size Sorting Test:

Table 04: Results of the Size Storing Test for group 02

Results Test phases	Min	Max	Success rate
Square shape	–	2	79%
Rectangular shape	0	2	
Circular shape	–	2	
Hollow shape	0	2	
Triangular shape	–	2	

Most participants achieved high scores, with a maximum of 10 and a minimum of 6. These results indicate effective use of projective and Euclidean relations across the different items. In Item 1, all answers were correct except one. In Item 4, eight participants responded incorrectly. Items 3 and 5 yielded entirely correct responses. Item 2 again presented challenges due to shape complexity, with only nine participants providing correct answers.

6.3 Presentation and analysis of the results of group 03 (05th grade):

6.3.1 Presentation and analysis of the Three Mountains Task

Table 05: Results of phases 01 and 02 of the Three Mountains Test for group 03

Results Test phases	Min	Max	Success rate
Phase one (B-C-F)	4	6	89.16%
Phase two (I-E-B-F-C)	5	10	76.5%

The table shows that the scores of the 3rd group are high, as the success rate is 89.16% in the 1st phase and 76.5% in the 2nd. This confirms that these learners used well the projective and Euclidean relations, as they used the topological indices (number, color, and size) and, then, employed the projective relations that helped give exact answers. Despite the difficulties in the questions, they used the topological indices that facilitated the answer and the projective relations to give exact answers. As for questions F and C, they did not find big difficulties because they handled the projective dimensions and coordinated the positions of many things. The results of the 2nd phase were not different, as the children found the correct situations of all the questions and respected the necessary dimensions and distances because they managed to coordinate the things and use the Euclidean relations. In general, despite the difficulties in each phase, the informants gave good answers thanks to the projective and Euclidean relations, and the good coordination of the dimensions (behind- in front of- left-right).

6.3.2 Presentation and analysis of Size Sorting Test:

Table 06: The results of the Size Storing Test for group 03

Results Test phases	Min	Max	Success rate
Square shape	—	2	83%
Rectangular shape	0	2	
Circular shape	—	2	
Hollow shape	0	2	
Triangular shape	—	2	

The results show that the children of group 03 got high results. In this regard, the answers of items 01, 03, and the last are all correct, while in the 2nd and 04th, some were correct and some were wrong. In general, these children used the projective and Euclidean concepts to succeed.

6.4 Statistical Summary of the Three Groups

The following lines show the arithmetic means and percentages of the 03 groups in the two tests.

Table 07: the results of the 03 groups in the Three Mountains Test

Groups	Arithmetic mean	Standard deviation	Success rate
Group 01 (3 rd grade)	9,35	1,98	59,68%
Group 02 (4 th grade)	11,65	1,75	%72,87
Group 03 (5 th grade)	13	3,78	81,25%

The results show big differences in the results of the 03 groups, as the arithmetic mean of group 01 is 9.35, the standard deviation is 1.98, and the success rate of 59.68%. Besides, group 02 had better results, as the arithmetic mean is 11.65, the standard deviation is 1.75, and the success rate is 72.87%. Moreover, group 03 had the best results, as the arithmetic mean is 13, the standard deviation is 3.78, and the success rate is 81.25%.

Table 08: Results of the 03 groups in the Size Sorting Test

Groups	Arithmetic mean	Standard deviation	Success rate
Group 01 (3 rd grade)	7,8	2,48	78%
Group 02 (4 th grade)	7,9	2,3	79%
Group 03 (5 th grade)	8,8	1,43	88%

The results show big differences in the results of the 03 groups, as the arithmetic mean of group 01 is 7.8, the standard deviation is 2.48, and the success rate is 78%. Besides, group 02 had an arithmetic mean of 7.9, a standard deviation of 2.3, and a success rate of 79%. Moreover, group 03 had the best results, as the arithmetic mean is 8.8, the standard deviation is 1.43, and the success rate is 88%.

7. Discussion of the results:

Analysis of the two tests reveals differences in spatial cognition across the three groups. In the Three Mountains Task which assesses the level of spatial representation and the use of projective and Euclidean concepts along the dimensions behind/in front of and left/right, a positive relationship between age and performance is evident. Group 3 (5th grade) obtained the highest scores, while the other two groups exhibited considerable difficulty. Group 1 (3rd grade) relied predominantly on topological concepts, neglected projective and Euclidean relations, and produced subjective, egocentric responses contrary to Piaget's claim that children should be capable of completing this task from age 7. Group 2 (4th grade) made greater efforts: participants initially relied on topological concepts before progressing toward projective and Euclidean ones, taking additional time to respond. Group 3 demonstrated the strongest performance, attributable to their ability to coordinate the dimensions behind/in front of and left/right and their use of projective and Euclidean spatial concepts, reflecting a more developed level of spatial representation.

The results of the three groups show considerable variation in spatial understanding, which aligns with the findings of Diamond and Carey (2019), who confirmed that spatial cognitive development is gradual and that individual differences are strongly influenced by environmental and cultural experiences. Our findings also concur with those of Lee and Chang (2021), who demonstrated that 5th-grade children (aged 10–11) perform significantly better on complex spatial representation tasks compared to their 3rd- and 4th-grade counterparts.

Regarding the Size Sorting Test which assesses projective and Euclidean geometry results across all three groups were stronger than on the first test. Most children produced correct answers, demonstrating an ability to understand projective and Euclidean geometry, likely facilitated by participation in arts and crafts classes. The social and familial environment also appears to support the acquisition of geometric shapes. These findings are consistent with those of Wilson and Henderson (2022), who showed that craft activities and scientific experiments are vital to the development of children's geometric and projective understanding. The study by Cohen et al. (2023) further supports the premise that the social and familial environment influences the acquisition of spatial concepts, noting that the quality of cognitive stimulation in the home and school environment strongly affects the development of complex spatial understanding.

These results suggest that the participants follow the same spatial development sequence identified by Piaget, who argued that space is not immediately given but is constructed through a gradual process in which topological structures emerge first, followed by Euclidean and projective structures. According to Piaget, the child's space is initially topological during the first two sub-stages of the sensorimotor phase, after which projective space develops; simultaneously, the child begins to use metric relations, rendering space Euclidean (Robin, 2022, p. 363). The discrepancy between the developmental stages observed in the present sample and those described by Piaget may be attributed to sociocultural differences. Piaget himself acknowledged that the timing of developmental stages is variable and context-dependent, and that social milieu and prior experience may accelerate, delay, or impede the emergence of a given stage. The study by Martinez et al. (2020) further explains this discrepancy, noting that spatial development is closely linked to the educational and cultural practices of the child's environment. Smith and Brown (2021) similarly confirmed that the developmental sequence follows a general Piagetian pattern, with individual variation attributable to the child's sociocultural context.

8. Conclusion:

Space may be understood as the surrounding reality whose mental image is formed once a set of relations among objects is constructed in the human mind. For the child to develop these relations and represent them spatially, he or she must progress through successive developmental stages tied to age, as Piaget demonstrated in his foundational studies. Nevertheless, cross-cultural research has consistently shown that the sociocultural environment influences the timing at which these stages emerge. The present study sought to determine whether Algerian children follow the same developmental sequence described by Piaget in achieving spatial representation. To this end, a sample of 60 children aged 8 to 12 from an Algerian primary school was studied using the Three Mountains Task and the Size Sorting Test.

The findings indicate that participants follow the same developmental sequence identified by Piaget, but with a delay relative to the ages he specified. This confirms that the Algerian sociocultural environment affects the pace of spatial representational development in children. On this basis, further investigation into this topic is strongly recommended, given its foundational role

in the acquisition of academic skills. Researchers and students are encouraged to conduct similar studies on larger and more diverse samples.

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