



**Marija S. Vukobradović**

**Preschool Institution “Boško Buha”, Belgrade, Republic of Serbia**

**Jasmina V. Milinković<sup>1</sup>**

**University of Belgrade, Teacher Education Faculty,  
Republic of Serbia**

**Original  
scientific paper**

Paper received: Dec 5 2019  
Paper accepted: May 29 2020  
Article Published: Jul 20 2020

## ***The Function of Integrative Approach in the Initial Understanding of Spatial Relations<sup>2</sup>***

### **Extended summary**

The paper examines the development of initial spatial reasoning. It aims to consider the extent to which work on integrative content contributes to the initial understanding of spatial relations in preschool children. Reasoning about spatial relations is an element of spatial reasoning that refers to the location and orientation of objects in space. The intuitive development of spatial reasoning begins from the first learning about oneself and the world around oneself. In the process of perception and differentiation of spatial relations, building a scheme of one's own body is an initial condition for experiencing space, and understanding spatial relations. When introducing children to the properties of selected spatial relations, mathematizing specific examples of relations between real objects that are known on an intuitive level, we come to the abstract concept of spatial relations. An integrative approach to the processing of mathematical content starts from the position that knowledge is a holistic system that is in the process of constant transformation. Such circumstances require the encouragement of the overall development of children related to personal experience and their activity. The integrative approach, due to its general characteristics, structure, and orientation, provides the conditions for creating a favorable situation for encouraging transfers and generalization of thinking abilities. It is in line with the basic Bruner's premises.

---

1 [jasmina.milinkovic@uf.bg.ac.rs](mailto:jasmina.milinkovic@uf.bg.ac.rs)

2 This research is part of the research project “Concepts and strategies for ensuring the quality of basic education“, no. 179020, whose implementation has been funded by the Ministry of Education, Science, and Technological Development of the Republic of Serbia (2011–2019).

Copyright © 2020 by the authors, licensee Teacher Education Faculty University of Belgrade, SERBIA.

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original paper is accurately cited.

---

The empirical part presents the results of action research within which the technique of planned observation was used, along with the active participation of researchers in the creation and preparation of everyday activities, different contexts and didactical tools related to initial formation of the concept of spatial relations. By applying the descriptive-analytical method, the method of researching non-causal connections and relations, and descriptive action empirical study, the possibilities of developing spatial relations using an integrative approach were examined. The research took place in two stages: 1) observation in which activities the child is most often motivated to integrate contents related to the initial understanding of spatial orientation and spatial relations with contents of other areas and life-practical situations 2) observation the ways how children represent spatial left-right relations encouraged by integrated activities, especially the relation of the position “left from - right from” in relation to themselves, the Earth, an object or an object. The results are presented through anecdotal notes, children’s statements, artworks, pictures (photographs), situations that represent an incentive for constructive activities of the child, and further development of knowledge and skills. The initial understanding of spatial relationships and the progress of children was assessed through four activities realized during 9 months. Summarizing the results and implications of the study, we can draw several conclusions about the effects of the integrated approach in primary mathematics education at preschool age, and in particular the contribution of integrated activities to the initial understanding of spatial relationships in preschool children: a) formation of mathematical concepts in preschool children could be considered as a process of careful selection of realistic contextual activities with real objects and iconic representations and structuring environment to be rich in stimulating integrated content necessary to promote the development of the process of abstraction discussed in the introductory part of the paper, b) construction of mathematical concepts in preschool based on carefully selected work with specific realistic objects, pictures and schemes provides spirall character of the learning process, c) In integrated activities with preschool children, it is possible to move through all levels of abstraction and enable children to iconically represent specific situations that gradually lead to a symbolic representations as discussed in vignettes, d) integrative contents, as well as everyday life situations, contribute to the development of a system of spatial orientation and spatial relations based on of practical and mental activities, e) leaps in learning are related to “moments of understanding” about which evidence is presented, f) building spatial orientation and spatial relations in children successfully occurs in context of multiple diverse integrated activities that presents complex elements of various fields of educational work, containing examples where common features are very pronounced as well as examples where “noise” is minimized to create a mental image of concepts. There is no doubt that, if we look at the pedagogical implications, we can conclude that the potential of an integrative approach in the development of spatial reasoning in preschool children is evident, and a critical examination of the proposed model of integrative approach opens the possibility of improving educational practice.

**Keywords:** spatial relations, spatial orientation, preschool education, integrative approach.

---

## References

- Arcavi, A. (2003). The role of visual representations in the learning of mathematics. *Educational Studies in Mathematics*, 52 (3), 215-241.
- Bandur, V., Potkonjak, N. (2006). *Istraživanje u školama*. Užice: Učiteljski fakultet.
- Bishop, A. J. (1980). Spatial abilities and mathematics achievement - A review. *Educational Studies in Mathematics*, 11, 257-269.
- Bruce, C., Sinclair, N., Moss, J., Hawes, Z. & Caswell, B. (2015). Spatializing the curriculum. In: Davis, B. & the Spatial Reasoning Study Group (Eds.). *Spatial reasoning in the early years: Principles, assestions, and speculations* (85-106). Routledge.
- Bruner, J. (1960). *The Process of Education*. Cambridge, Massacusetz: Harvard Unievristy Press.
- Casey, M. B., Nuttall, R. L. & Pezaris, E. (2001). Spatial-mechanical reasoning skills versus mathematics self-confidence as mediators of gender differences on mathematics subtests using cross-national gender-based items. *Journal for Research in Mathematics Education*, 32, 28-57.
- Clements D. H. & Battista M. T. (1992). Geometry and spatial reasoning. In: Grouws, D. (Ed). *Handbook of Research on Mathematics Teaching and Learning* (420-464). Mc Millan Publishing Company.
- Clements, D. H. & Sarama, J. (2007). Early Childhood Mathematics Learning. In: Lester, F. K. (Ed.). *Second Handbook of Research on Mathematics Teaching and Learning, vol 1* (461-555). New York: Information Age Publishing.
- Czaplewska E., Bogdanowicz, K. & Karczorowska-Bray, K. (2009). An evaluation of visual spatial orientation in preschool children. *Acta Neuropsychologica*, 7 (1), 21-32.
- Ćebić, M. (2010). *Početno matematičko obrazovanje predškolske dece*. Beograd: Učiteljski fakultet.
- Dejić, M. (2015). *Metodika razvoja početnih matematičkih pojmova*. Beograd: Učiteljski fakultet.
- Dobrić, N., Brkić, P. (1984). *Razvijanje opažanja i saznanja o prostoru kod dečje predškolske ustanove*. Beograd: Zavod za unapređenje vaspitanja i obrazovanja grada Beograda.
- Đokić, O. (2014). Realno okruženje u početnoj nastavi geometrije. *Inovacije u nastavi*, 27 (2), 7-21.
- Egerić, M. (2006). *Metodika razvoja početnih matematičkih pojmova*. Jagodina: Učiteljski fakultet Univerziteta u Kragujevcu.
- Elia, I., Van den Heuvel-Panhuizen, M. & Gagatsis, A. (2018). Geometry Learning in the Early Years: Developing Understanding of Shapes and Space with a Focus on Visualization. In: Kinnear, V., Yee Lai, M. & Muir, T. (Eds.). *Forging Connections in Early Mathematics Teaching and Learning* (73-95). Singapore: Springer.
- Elkind, D. (1978). Biće i obrazovanje. *Predškolsko dete*, 4, 299-315.
- Ion Ene, M., Iconomescu., T-M., Talaghir, L-G. & Neofit, A. (2016). Developing Spatial and Body Schema Orientation in Preschoolers and Primary School through Physical Activities. *International Journal of Educational Sciences*, 15 (1,2) 27-33.

- 
- Kovačević Andrijanić, Ž. (2009). Odgojno-obrazovno okruženje kao poticajnik razvoja potencijalno verbalno-lingvistički darovite dece. U: Vujičić, L., Duh, M. (ur.). *Interdisciplinarni pristup učenju* (143–150). Rijeka: Učiteljski fakultet, Maribor: Pedagoški fakultet.
  - Lean, G. & Clements, M. A. (1981). Spatial ability, visual imagery, and mathematical performance. *Educational Studies in Mathematics*, 12, 267–299.
  - Lowrie, T., Logan, T. & Ramful, A. (2017). Visuospatial training improves elementary students' mathematics performance. *British Journal of Educational Psychology*, 87 (2), 170–186.
  - Maksimović, J., Bandur, V. (2013). Savremena akciona istraživanja i metodološko obrazovanje nastavnika refleksivnog praktičara. *Teme*, 37 (2), 595–610.
  - Maričić, S., Čalić, M. (2014). Muzička igra u razvoju matematičkog pojma kod predškolske djece [Musical play in the development of a mathematical concept in preschool children]. U: Joković, M. (ur.). *Naše stvaranje: zbirka radova sa Devetog simpozijuma sa međunarodnim učestvovanjem „Vaspitač u 21. veku“* (205–213). Aleksinac: Visoka škola za vaspitače strukovnih studija.
  - McGee, M. G. (1979). Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. *Psychological Bulletin*, 86, 889–918.
  - McGraw, S. A. (2003). *Integrated Mathematics: Choices and Challenges*. NCTM: Reston, VA.
  - Milinković, J. (2014). Matematičko modelovanje u nastavnim sistemima. *Inovacije u nastavi*, 27 (2), 45–55.
  - Newcombe, N. S. & Huttenlocher, J. (2000). *Making space: The development of spatial representation and reasoning*. Cambridge, MA: MIT Press.
  - Newcombe, N. S. (2013). Spatial relationships: using spatial thinking to teach Science, Mathematics and social science. *American Educator*, 2013, 26–40.
  - O'Keefe, J. & Nadel, L. (1978). *The hippocampus as a cognitive map*. Oxford, U.K.: Oxford University Press.
  - Pijaže, Ž., Inhelder, B. (1982). *Intelektualni razvoj deteta*. Beograd: Zavod za udžbenike i nastavna sredstva.
  - Rich, K. & Brendefur, J. L. (2018). The Importance of Spatial Reasoning in Early Childhood Mathematics. *Early Childhood Education*. Retrieved January 18, 2020. from www: <https://www.intechopen.com/books/early-childhood-education/the-importance-of-spatial-reasoning-in-early-childhood-mathematics>.
  - Roberts, R. J., Jr., & Aman, C. J. (1993). Developmental differences in giving directions: Spatial frames of reference and mental rotation. *Child Development*, 64, 1258–1270.
  - Stewart, R., Leeson, N., & Wright, R. J. (1997). Links between early arithmetical knowledge and early space and measurement knowledge: An exploratory study. In F. Biddulph & K. Carr (Eds.), *Proceedings of the Twentieth Annual Conference of the Mathematics Education Research Group of Australasia*, vol. 2 (477–484). Hamilton, New Zealand: MERGA.
  - Van den Bos, G. R. (Ed.). (2007). *APA dictionary of psychology*. American Psychological Association. Retrieved October 1, 2019. from www: <https://dictionary.apa.org/perception-of-spatial-relations>.
-