METHODS OF DEVELOPING STUDENTS' SPATIAL THINKING ABILITIES IN DRAWING LESSONS

Go'zalxon Olmosboy qizi Oxunjonova
Namangan State Pedagogy Institute

Abstract: This article examines effective methods, pedagogical approaches, and didactic technologies that serve to develop students' spatial thinking in drawing lessons. Spatial thinking is the ability of students to mentally model the shape, position, size of objects in space, and the relationships between them, and plays a central role in the formation of technical and engineering competencies. The study analyzed the effectiveness of traditional and innovative methods, the level of complexity of graphic tasks, the effectiveness of visual aids, and the impact of the use of information and communication technologies on student thinking. Based on the results of practical experience, conclusions are given on improving the educational process that serves to develop spatial thinking.

Keywords: spatial thinking, drawing, graphic image, technical thinking, didactic methods, AQT, visualization

In the current rapidly developing technological development, preparing students for a specific type of thinking - spatial, technical and creative thinking - is recognized as one of the main tasks of the education system. Spatial thinking forms the student's ability to imagine, model and analyze a three-dimensional object based on two-dimensional graphic images. This serves as the foundation for successful work in such professional areas as engineering, architecture, technology, computer graphics in the future. The science of drawing plays a key role in the formation of these competencies, as it develops students' analytical and visual thinking by creating projections of spatial objects, reading them and comparing them.

This article systematically studies methods that serve to develop students' spatial thinking in the process of drawing lessons, analyzes the practical effectiveness of educational technologies, and discusses them on the basis of experimental work. The research is aimed at developing practical proposals for improving the methodological foundations of drawing education and increasing students' graphic literacy.

Scientific research on the issue of spatial thinking in drawing lessons was studied by psychologists such as J.Piaget, L.Vygotsky, D.Bruner, whose studies shed light on the cognitive foundations of the gradual formation of spatial imagination, strengthening visual perception, and developing graphic thinking. In modern pedagogy, scientists such as A.Abdullayev, M.Makhmudov, S.Mustafakulov have studied the methodology of drawing education, the application of the principles of demonstration, and the impact of graphic tasks on student creativity.

Methodologically, the research was conducted in the following stages:

analysis of existing scientific and methodological sources on the topic;

determine the level of spatial thinking of students in the process of completing practical tasks in drawing;

conducting test lessons based on demonstration models, geometric shapes, 3D programs, and AR technologies;

conducting diagnostic tests and observations to measure lesson effectiveness;

Statistical analysis, comparison, and conclusion of experimental results.

This study used a combination of qualitative (observation, interview, activity analysis) and quantitative (statistical processing of test results) methods.

The study assessed the students' spatial thinking skills at the initial, intermediate, and final stages. When comparing traditional methods (drawing on the board, measuring, and drawing projections) with innovative methods (3D visualization, modeling programs, and AR applications), it was observed that the spatial thinking skills of students in the second group developed much faster and more effectively.

Table 1 below reflects the initial diagnostic results.

Table 1. Initial spatial thinking indicators of students (in percent)

Indicators	High	Medium	Low
Ability to read projections	18%	42%	40%
Visualizing a spatial object	15%	38%	47%
Identifying errors in a drawing	20%	36%	44%
Three-dimensional figure modeling	12%	33%	55%

The visual models, 3D programs (SketchUp, AutoCAD School Edition), AR visualization tools, and transformation exercises used in the experiment significantly developed students' spatial thinking. It was observed that students became more active in imagining the shape of a three-dimensional object, converting it into a graphic image, and creating complex projections.

Table 2 below shows the final results of the experiment.

Table 2. Changes in students' spatial thinking after using new methods

Indicators	High	Medium	Low
Ability to read projections	46%	39%	15%
Visualizing a spatial object	49%	37%	14%
Identifying errors in a drawing	52%	34%	14%
Three-dimensional figure modeling	48%	40%	12%

The results showed that spatial thinking is especially effectively developed through the following techniques:

- Tasks based on 3D modeling;
- spatial transformation exercises (rotation, translation, projection);
- use geometric models of real objects;
- Use of AR and VR technologies;
- graphic dictation, project assignments, combinatorial analysis exercises.

These methods encourage students to be active, increase their interest in drawing, enhance their creative thinking, and strengthen their technical skills.

The development of spatial thinking in drawing lessons is one of the integral directions of the modern educational process. Spatial thinking not only forms the skills of drawing and reading drawings, but also expands the technical thinking, logical thinking, ability to solve problem situations, creative approach and imagination of students. The results of the study show that the

combined use of innovative teaching technologies, along with traditional methods, forms students' thinking more deeply. In particular, the use of 3D modeling programs, AR visualization, the use of geometric models of real objects, and exercises based on the transformation of projections significantly increase the level of spatial thinking in students. The results of the experiment confirmed that the students' skills in reading projections, imagining three-dimensional figures and reflecting them in drawings have significantly improved.

It is also necessary to use practical tasks, problem tasks, and project work in drawing lessons that encourage students to think independently and require an analytical approach. Gradual increase in the level of complexity of graphic tasks, taking into account the individual abilities of students, and strengthening interdisciplinary integration also have a positive effect on the development of spatial thinking. The results of the article offer methodological recommendations for teachers and serve to further strengthen the place of drawing in the educational process.

References

1. Abdullayev A. - Chizmachilikni o'qitish metodikasi - Toshkent: O'qituvchi nashriyoti, 2019. - 245 b.

2. Maxmudov M. - Texnik grafikaga kirish - Toshkent: Fan, 2020. - 198 b.

3. Vygotskiy L. - Mantiqiy va texnik tafakkur psixologiyasi - Moskva: Pedagogika, 1986. - 312 b.

4. Piaget J. - Child's Conception of Space - New York: Routledge, 1970. - 412 p.

5. Bruner D. - Toward a Theory of Instruction - Cambridge: Harvard University Press, 1966. - 192 p.

6. Mustafaqulov S. - Texnik fanlarni o'qitish metodikasi - Samarqand: SamDU nashriyoti, 2018. - 220 b.

7. SketchUp Education Guide - 3D Modeling Methods - London: EDU Press, 2021. - 134 p.

8. AutoCAD School Edition - Graphical Representation Manual - Berlin: Springer, 2022. - 167 p.

9. Sattarov, F. I. (2024). Practical and theoretical recommendations on drawing landscape compositions. Science and Education, 5(12), 238-241.

10. Islomovich, S. F. QALAMTASVIR MASHG „ULOTLARIDA TALABALARNI KOMPOZISIYA OID BILIM VA MALAKALARINI RIVOJLANTIRISH.

11. Sattarov, F., & Ashanova, G. (2025). TASVIRIY SAN'AT DARSLARIDA PEDAGOGIK RASM CHIZISHNING O'ZIGA XOS XUSUSIYATLARI. Universal xalqaro ilmiy jurnal, 2(4.3), 145-149.

12. ogli Oktyabrov, M. A. (2025). THE EMOTIONAL EXPRESSION OF ARTISTS THROUGH COLORS AND THE PSYCHOLOGICAL EFFECT OF COLORS IN ARTWORKS. European Review of Contemporary Arts and Humanities, 1(4), 30-34.

13. Adhamjon o'g'li, O. M. (2025). INNOVATSION YONDASHUV ASOSIDA BOLALARINI DEKORATIV RASM CHIZISHGA O 'RGATISHNING DIDAKTIK AHAMIYATI. IMRAS, 8(6), 142-147.

14. Adhamjon o'g'li, O. M. (2025). NATYURMORT TUZISH VA UNI TASVIRLASH USULLARI. INTELLECTUAL EDUCATION TECHNOLOGICAL SOLUTIONS AND INNOVATIVE DIGITAL TOOLS, 3(33), 75-80.

15. Adhamjon o'g'li, O. M. (2024). QAYSI BIRI YAXSHIROQ: NATURADANMI YOKI FOTOSURATDANMI?. INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION, 3(31), 222-225.

16. Raximov, H. (2025). O 'QUVCHILARGA MANZARA JANRINI O 'RGATISHDA INNOVATSION PEDAGOGIK TEXNOLOGIYALARNI O 'RNI. Universal xalqaro ilmiy jurnal, 2(4.3), 214-218.

17. Раҳимов, Х. (2023, December). ТАСВИРИЙ САНЪАТ НАМУНАЛАРИ ОРҚАЛИ САНЪАТШУНОСЛИК СОҲАСИГА ТАЙЁРЛАШ. In INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE on the topic:"Priority areas for ensuring the continuity of fine art education: problems and solutions" (Vol. 1, No. 01).

18. Raximov, H., & Usmonkulova, R. (2025). O 'ZBEKISTONDA RANGTASVIR SAN'ATI RIVOJLANISHI. Universal xalqaro ilmiy jurnal, 2(4.3), 238-242.

19. Umarjon o'g'li, H. R. (2021). Technologies for Improving Composition and Drawing Skills Based on the Rules of Composition. Galaxy International Interdisciplinary Research Journal, 9(12), 765-767.

20. ogli Rakhimov, H. U. AJMR. AJMR.

21. Komoldinov, S. (2025). MANZARA CHIZISHNING NAZARIY ASOSLARI VA RASSOMLAR ASARLARI TAXLILI MANZARA CHIZISHNING NAZARIY ASOSLARI VA RASSOMLAR ASARLARI TAXLILI. Universal xalqaro ilmiy jurnal, 2(4.3), 264-267.

22. Komoldinov, S. J. O. G. L., & Isaboyeva, M. I. Q. (2025). Manzara kompozitsiyasini rangtasvir texnologiyasi asosida yaratishning badiiy ifoda vositalari. Science and Education, 6(11), 932-937.

23. Jomoldin o'g'li, K. S. SCIENCE, RESEARCH AND DEVELOPMENT.

24. Xasanboy o'g'li, B. A. TALABALARNI KASBIY-PEDAGOGIK QOBILYATLARINI RIVOJLANTIRISH METODIKASI. Economy and Innovation ISSN, 2545-0573.

25. Xasanboy O'g'li, B. A. O'quv jaryonida qalamchizgi va qoralamalarni bajarishda talabalarni kasbiy-pedagogik kompetensiyasini rivojlatnirish texnalogiyasi. Scientific bulletin of namsu-научный вестник намгу-namdu ilmiy Axborotnomasi–2023-yil_7-son.

26. Boltaboev, A. X. O. G. L. (2025). Technologies for the development of students' creative abilities in individual classes. Science and Education, 6(11), 909-911.

27. Badriddinovich, O. B. (2024). TASVIRIY SAN'AT RIVOJIDA UYG'ONISH DAVRI AHAMIYATI. SO 'NGI ILMIY TADQIQOTLAR NAZARIYASI, 7, 6-10.

28. Suyarov, N. T., & Erkaev, E. T. (2021). IMPLEMENTATION OF NATIONAL-REGIONAL COMPONENT IN THE EDUCATIONAL PROCESS IN THE REPUBLIC OF UZBEKISTAN. CURRENT RESEARCH JOURNAL OF PEDAGOGICS, 2(08), 117-121.

29. Suyarov, N. T. (2021). Implementation of the national-regional component in the educational process. Asian Journal of Research in Social Sciences and Humanities, 11(11), 511-514.

30. Suyarov, N. (2019). TIPS AND METHODS OF USING NATIONAL FOLKLORE IN APPLIED ART LESSONS. Scientific Bulletin of Namangan State University, 1(3), 321-325.

31. Abdullayev, O. E. (2021). The impact of historical monuments on human spirituality. Academicia: An International Multidisciplinary Research Journal, 11(8), 263-268.

32. Shokirjonovna, S. G., & Ergashevich, A. O. (2024). THE TECHNOLOGY OF CREATING A THEMATIC COMPOSITION: INTERPRETING COMPOSITIONAL ISSUES IN PAINTINGS. Galaxy International Interdisciplinary Research Journal, 12(2), 12-14.

33. Ibrokhimjonovna, K. I., & Ergashevich, A. O. (2024). EXPLORING THE SCIENTIFIC CHANGE OF COLOR RELATIONSHIPS IN THE LANDSCAPE GENRE. Galaxy International Interdisciplinary Research Journal, 12(2), 18-21.

34. Abdullayev, O. E. (2021). Establishment and development of Uzbek theater. Asian Journal of Multidimensional Research, 10(9), 434-440.

35. Nabiyev, B., & Usmonova, Y. (2025). NATYURMORT JANRINING RIVOJLANISH TARIXI VA BOSQICHLARINI O ‘RGANISHNING AHAMIYATI. Universal xalqaro ilmiy jurnal, 2(4.3), 196-200.

36. O’G’Li, B. A. A., & Anvarova, X. I. Q. (2025). Ranglarning xususiyatlari va insonlarga ta’siri. Science and Education, 6(6), 753-757.

37. O’G’Li, B. A. A. (2021). Talabalarda kompozisiya tuzish va tasvirlash mahoratlarini takomillashtirishda shakllarni masofada ko’rish texnologiyalarini rivojlantirish. Science and Education, 2(9), 333-343.

38. Nabiyev, B. A. O. (2025). The importance of using interactive methods in developing the creative competence of primary school students. Science and Education, 6(10), 461-465.

39. Abdullayev, O. K. (2025). TALABALARNING KOMPOZITSIYA TUZISH VA TASVIRLASH KO ‘NIKMALARINI RIVOJLANTIRISH USULLARI. Universal xalqaro ilmiy jurnal, 2(4.3), 1-5.

40. Matkarimov, A. M. A. (2024). ANIQ FANLARDA MUSTAQIL TA’LIMNI TASHKIL ETISHDA CHIZMA GEOMETRIYA VA MUHANDISLIK GRAFIKASI FANINING O ‘RNI. Universal xalqaro ilmiy jurnal, 1(12), 375-377.

41. Mirziyoyev, S. (2018). TASVIRIY SAN’AT MASHG’ULOTLARINING ZAMONAVIY TA’LIMI Abdullayev O’ktamjon Ergashevich NamDU TSMG kafedrasi mudiri, dotsent. НАМАНГАН ДАВЛАТ УНИВЕРСИТЕТИ, 9.

42. Oktabrov, M. A. O. G. L. (2025). Natyurmort kompozisiyasida yo ‘l qo ‘yiladigan xatolar va ularning oldini olish. Science and Education, 6(11), 955-960.