AJLLSE GLOBAL RESEARCH NETWORK

AMERICAN Journal of Language, Literacy and Learning in STEM Education
Volume 3, Issue 11, 2025 ISSN (E): 2993-2769

Enhancing Students' Spatial Reasoning in Academic Lyceums through the use of the Desmos Platform

Muborak Abdullayeva
Academic Lyceum of Tashkent Institute of Textile and Light Industry

Abstract. *This article examines the didactic potential of the Desmos platform in developing spatial reasoning among academic lyceum students. It explores the role of interactive graphical tools in shaping spatial thinking, enhancing cognitive engagement, and strengthening visual perception. The study is based on an experimental methodology, with statistical analysis of the results obtained from lessons conducted using the Desmos platform.*

Key words: *spatial reasoning, Desmos, academic lyceum, interactive learning, visual perception, mathematical modeling.*

INTRODUCTION

Spatial reasoning refers to students' ability to mentally visualize geometric shapes, coordinate systems, movements, and transformations. At the academic lyceum level, this skill is essential not only for mathematics but also for physics, computer science, and engineering disciplines. Desmos is an online graphing calculator that enables students to construct, manipulate, and analyze graphs in real time. This article provides a scientific analysis of the effectiveness of the Desmos platform in enhancing spatial reasoning skills.

METHODS

The Desmos platform is widely used in educational institutions around the world, particularly in mathematics instruction, where it is recognized as a powerful interactive graphical tool. It serves as an effective medium for developing students' spatial reasoning, functional thinking, and visual perception.

Desmos allows students to draw, modify, analyze, and model graphs in real time. Its core features include: interactive graphing of functions, equations, and parametric curves; visual manipulation to deepen conceptual understanding; real-time observation of changes; gamified exercises and tasks for learners; and free browser-based access with mobile compatibility.

Globally, the Desmos platform has been successfully integrated into various educational systems:

United States: In the Uncommon Schools network, Desmos was used in Algebra I classes, resulting in a 30% improvement in students' standardized test scores. Teachers also effectively utilized Desmos during remote learning via Zoom, helping maintain mathematical engagement during the pandemic.

Europe: According to the *European Journal of Mathematics and Science Education*, DESMOS is widely used in European schools to teach functions, coordinate geometry, and transformations. Students demonstrate a deeper understanding of the relationship between algebraic expressions and graphical representations, thereby strengthening their spatial reasoning.

Asia: In technologically advanced countries such as Singapore, South Korea, and Japan, DESMOS is employed in STEM education to develop students' analytical and visual skills. Its mobile adaptability makes it suitable for both classroom and home use.

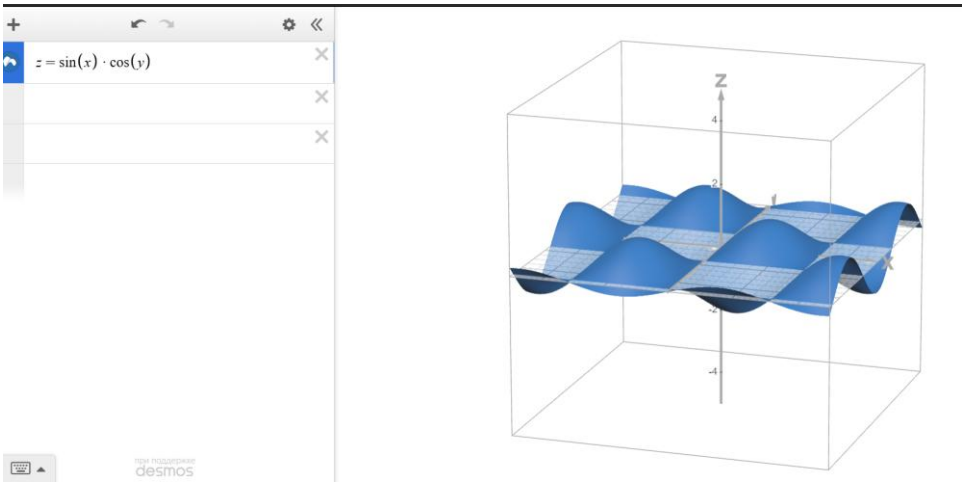
A 2025 study published in the *Future Engineering Journal* found that Desmos promotes deeper conceptual understanding compared to traditional graphing calculators. The study noted: *"DESMOS provides interactive features that foster meaningful engagement and deeper comprehension of mathematical concepts."*

Tools offered by Desmos Studio — including the graphing calculator, geometry environment, and 3D visualization — are freely accessible worldwide. Teachers can integrate Desmos into their lessons using ready-made activities, exercises, and visual models available directly on the platform.

RESULTS

In mathematics lessons focused on Algebra and Foundations of Mathematical Analysis, teachers used the Desmos platform to visually demonstrate spatial shapes, symmetry, rotation, and translation transformations. They also employed it to analyze functions graphically, identify maxima, minima, and intercepts.

Manipulating graphs, adjusting parameters, and visualizing changes in real time significantly improved students' comprehension. Learners became adept at expressing their ideas through graphical representations, which in turn enhanced their analytical and visual thinking skills.



As demonstrated in the example above, visualizing trigonometric functions in a 3D format significantly broadens students' conceptual understanding of these functions.

DISCUSSION

The Desmos platform has proven to be an effective tool for enhancing spatial reasoning, significantly increasing students' learning motivation. Through visual learning technologies, complex concepts can be simplified, fostering independent thinking and enabling opportunities for self-assessment. The interactive nature of Desmos allows students to quickly identify and correct errors, promoting a constructive learning process. Its dynamic feedback mechanisms encourage exploration and experimentation, which are essential for developing higher-order cognitive skills in mathematics.

Moreover, the platform's ability to visualize transformations such as symmetry, rotation, and translation in real time supports deeper conceptual understanding. Students become more engaged when they can manipulate graphs and observe immediate outcomes, which strengthens both their analytical and visual thinking.

CONCLUSION

Utilizing the Desmos platform in academic lyceums is a pedagogically sound method for enriching students' spatial reasoning. It cultivates essential skills such as graphical thinking, visual perception, and mathematical modeling. The platform's accessibility, interactivity, and adaptability make it a valuable resource for modern mathematics instruction.

Future research is recommended to explore the integration of Desmos into other subject areas, the development of interdisciplinary learning modules, and the professional training of educators in using digital tools effectively. Such initiatives could further enhance the quality and inclusivity of STEM education.

REFERENCES

1. Xalimov M.K. (2023). *Modulli kompetentli yondashuv asosida talabalarning fazoviy tasavvurini rivojlantirish metodikasi.* Inter Education & Global Study (2023, No. 2).
2. **Xamrayeva, N.** (2023). *Ta'limda innovatsion texnologiyalardan foydalanish*. A.Qodiriy nomidagi Jizzax davlat pedagogika universiteti. Academia.edu. Vol. 3.
3. N.Xusniddinova. (2024). Talabalarning fazoviy tasavvurlarini oshirishda to‘g‘ri chiziq va ularning o‘zaro vaziyatlariga oid masalalarning ahamiyati. Vol. 2 No. 5. Journal of Universal Science Research.
4. Sh.Otaxonova (2025). *Chizmachilik fanida fazoviy tasavvurni rivojlantirishning yangi imkoniyatlari.* Nordic Research.
5. https://www.desmos.com
6. https://www.futureengineeringjournal.com