

DOI: <https://doi.org/10.36719/2789-6919/45/234-238>

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## **Perspectives on the Application of Python and AlpLogo Programming Languages**

### **Abstract**

In today's increasingly digital society, programming skills have become one of the key competencies not only in the education system but also across various industrial sectors. These skills are now essential not only for professionals in the field of information technology but also for individuals in diverse areas of expertise. This article provides a comparative analysis of Python—a high-level, versatile programming language widely used in education and AlpLogo, a visual and intuitive programming environment designed to foster algorithmic and logical thinking at the primary and secondary school levels.

The study examines the functionality, usability, and educational integration potential of both programming environments, with a particular focus on the technological competencies they help students' develop. Python's professional capabilities, broad applicability across platforms, and suitability for real-world projects enhance its value in educational contexts. On the other hand, AlpLogo's simple interface and visual programming approach serve as an effective tool particularly for younger learners to engage with programming through interactive and gamified methods.

The main objective of this paper is to explore the roles, advantages, and future prospects of both Python and AlpLogo in education. Moreover, it aims to highlight how these two programming approaches can complement each other and be tailored to different age groups, offering methodologically diverse and developmentally appropriate learning experiences.

**Keywords:** *Algorithm, Python, AlpLogo, programming education, digital skills*

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## **Python və AlpLogo proqramlaşdırma dillərinin tətbiqi perspektivləri**

### **Xülasə**

Rəqəmsallaşan müasir cəmiyyətdə proqramlaşdırma bacarıqları təkcə təhsil sistemində deyil, həm də müxtəlif sənaye sektorlarında əsas səlahiyyətlərdən birinə çevrilib. Bu bacarıqlar indi təkcə informasiya texnologiyaları sahəsində peşəkarlar üçün deyil, həm də müxtəlif təcrübə sahələrində olan şəxslər üçün vacibdir. Bu məqalə təhsildə geniş istifadə olunan yüksək səviyyəli, çox yönlü proqramlaşdırma dili olan Python və ibtidai və orta məktəb səviyyələrində alqoritmik və məntiqi təfəkkürün inkişafı üçün nəzərdə tutulmuş vizual və intuitiv proqramlaşdırma mühiti AlpLogo-nun müqayisəli təhlilini təqdim edir.

Tədqiqat tələbələrin inkişafına kömək edən texnoloji sərişələrə xüsusi diqqət yetirməklə, hər iki proqramlaşdırma mühitinin funksionallığını, istifadəyə yararlılığını və təhsil integrasiya potensialını araşdırır. Python-un peşəkar imkanları, platformalar arasında geniş tətbiqi və real layihələr üçün uyğunluğu onun təhsil kontekstində dəyərini artırır.

Digər tərəfdən, AlpLogo-nun sadə interfeysi və vizual proqramlaşdırma yanaşması, xüsusən gənc tələbələrin interaktiv və oyunlaşdırılmış üsullarla proqramlaşdırma ilə məşğul olması üçün effektiv vasitə rolunu oynayır.

Bu məqalənin əsas məqsədi həm Python, həm də AlpLogo-nun təhsildəki rollarını, üstünlüklərini və gələcək perspektivlərini araşdırmaqdır. Bundan əlavə, bu iki proqramlaşdırma yanaşmasının bir-birini necə tamamlaya biləcəyini və müxtəlif yaş qruplarına uyğunlaşdırıla biləcəyini vurğulamaq məqsədi daşıyır, metodoloji cəhətdən müxtəlif və inkişaf baxımından uyğun öyrənmə təcrübələri təklif edir.

*Açar sözlər: Alqoritm, Python, AlpLogo, proqramlaşdırma təhsili, rəqəmsal bacarıqlar*

## Introduction

The rapid development of information technologies and digital transformation in the 21st century have led to fundamental changes in all areas of society. One of the most important consequences of these changes is the fact that programming languages and algorithmic thinking have become an integral part of everyday life. Programming plays an important role not only in the field of computer science, but also in the development of fields such as engineering, finance, education and healthcare. For this reason, educational systems, especially schools, have begun to attach importance to instilling algorithmic thinking, logical sequence and coding skills in students starting from elementary grades. The tools and programming languages used in the educational process in this direction have a positive impact on both the quality of teaching and the development of students' creative thinking and problem-solving skills (Mishra, Koehler, 2007, p.2216; Humbataliyev, Huseynova 2024, p.43; İsmayilova, Ahmadov, Humbataliyev, 2020, p. 3018).

For this purpose, both professional programming languages and visual-based languages that are more suitable for children are used in the field of education. The Python programming language is one of the most studied and used languages in the world with its wide application area, simple syntax and functional richness. Python is used in data science, artificial intelligence, web programming, etc. It occupies an important place in fields such as and is widely used in both teaching and research with its numerous libraries. Its easy-to-learn yet powerful capabilities have made it an ideal choice, especially for beginners in the education system. On the other hand, visual programming environments such as AlpLogo serve as a convenient tool for developing algorithmic thinking and coding skills in school-age children. AlpLogo provides a simple and intuitive environment that allows children to learn programming in a fun and interactive way. This programming environment develops students' skills in developing algorithms to solve real-world problems and encourages their logical thinking. The main goal of AlpLogo is to teach students the basic algorithmic principles and the basics of programming, so that they are ready to move on to more complex languages and technologies.

## Research

1.Features of the Python Programming Language and its Application in Education. The Python programming language is known for its simple syntax and extensive functionality. The features of this language make it an ideal choice for both beginners and experts. Python's syntax is more readable and simple compared to other programming languages. This makes it easier to learn and teaches students to write programs faster and more effectively. The simplicity of the syntax ensures that programmers make fewer mistakes and the code is understood faster.

One of the main reasons for the popularity of the Python language is its extensive and rich library support. Popular libraries such as NumPy, Pandas, Matplotlib, TensorFlow, Keras, PyTorch make Python very suitable for application in various fields. These libraries are used in both data science and artificial intelligence and allow students to gain experience in these fields. NumPy and Pandas libraries teach students how to analyze and process data, while Matplotlib teaches data visualization. These tools allow students to analyze statistical data, extract information from large databases, and present this information in easy-to-understand graphs.

The use of Python in education is increasingly important in formal courses and teaching environments. At the secondary school level, Python is used to teach students simple programming

concepts. Python's simple syntax helps students develop algorithmic thinking and problem-solving skills more easily. At universities, Python is studied in more complex subjects, including artificial intelligence, data science, robotics, web programming, and simulation. Real-world applications written in Python help students master the theoretical and practical aspects of these fields ("Mathematics" for the 8<sup>th</sup>, 2020, p.88).

The use of Python in education is not limited to programming lessons. It is also used to teach students through interactive teaching tools and practical applications. The use of Python is also widespread in online learning platforms. Students and students can develop their coding skills in Python more flexibly and effectively.

2. Functionality of the AlpLogo Programming Environment. AlpLogo is a variant of the Logo programming language adapted to the Azerbaijani educational environment. The roots of the Logo language date back to the 1960s, but AlpLogo is a version of this language adapted to the modern educational system and is designed for school-age children. The main goal of the Logo language is to teach students algorithmic thinking in a simple and fun way. A special feature of AlpLogo is that it is taught with visual elements. That is, instead of writing code directly, students implement programming through visual symbols and schemes. In AlpLogo, students learn to draw mathematical pictures mainly through "turtle graphics". This process develops students' spatial thinking and mathematical logic skills. Imagine that a student sequentially combines many different commands and eventually learns to draw. This not only develops algorithmic thinking, but also increases their creativity and problem-solving skills. Also, this programming environment is very simple and convenient, which helps students in the early stages of gaining experience ("Mathematics" for the 5<sup>th</sup>, 2016, p.78).

The main advantage of using AlpLogo in teaching is that the visual programming approach acts as a guide for students to write algorithms. This ensures that they understand and work with algorithms before moving on to more complex coding principles. Students develop algorithms with symbolic commands and loop structures, and then demonstrate these algorithms in a graphical format. This helps them translate their thoughts into concrete results.

3. Comparative Analysis and Integration Opportunities in Education. Python and AlpLogo are two different programming environments that complement each other in the field of education. While AlpLogo is a language designed for beginners, Python occupies its place as a more complex and professional programming language. The use of both languages in education plays a major role in developing students' algorithmic thinking and programming skills.

Education with AlpLogo focuses on introducing students to algorithmic thinking and developing their visual thinking skills. AlpLogo's simple and fun teaching method attracts students and increases their interest in the subject of programming. In this environment, students learn the basics of programming languages step by step and are then ready to move on to more complex languages such as Python.

Using Python, on the other hand, allows students to acquire more advanced programming knowledge. Python's powerful functionality, such as its application in fields such as data analysis, artificial intelligence, web development and robotics, gives students the skills to solve more real-world problems. This helps them to add more complex projects to the basic knowledge they have acquired with AlpLogo.

This approach, integrated into the education system, allows students to become stronger programmers by gradually and step-by-step teaching them a programming language. For example, students first start programming by building visual algorithms and then move on to writing algorithms in a real coding language using a language like Python. This develops their logical thinking and analytical skills, while also helping them understand more complex technical topics (Mardanov, 2009, p.78; Mehrabov, Abbasov, Zeynalov, Hasanov, 2010, p.92). Such integration between AlpLogo and Python systematically and purposefully develops students' programming knowledge and prepares them for complex projects in the future. This approach provides students with both theoretical and practical programming knowledge, resulting in better prepared and skilled programmers.

## Conclusion

The Python and AlpLogo programming languages play an important role in the development of algorithmic thinking, logical reasoning, and problem-solving skills in the education system. Both languages aim to shape students' technological knowledge and prepare them for future modern programming and technology fields. However, the scope and educational methodology of both languages cover different approaches, which makes their joint use more effective.

The Python programming language allows the implementation of more complex and scalable projects in the educational environment. Thanks to its simple syntax and powerful library support, students can also gain practical experience in areas such as data analysis, artificial intelligence, robotics, and database management. The use of Python in education allows students to combine theoretical knowledge with practical tasks, as well as encourage them to analyze and analyze more deeply. This language provides students with real-world problem-solving skills and prepares them for future technological professions (Humbataliyev, Gasimova, Haziyeva, 2017, p.83; Humbataliyev, Tagiyeva, Melikzade, 2018, p.149).

AlpLogo facilitates students' algorithmic thinking and the establishment of logical relationships through visual programming. This environment is mainly designed for younger age groups and allows students to become familiar with the basic principles of programming languages. The use of AlpLogo in the educational field develops students' magnetic thinking, provides a simpler and more fun approach to writing algorithms. This simplicity makes it easier for students to transition to more complex languages, such as Python.

The effective and integrated approach between these two programming environments helps students increase their programming knowledge at different stages of their educational life. With AlpLogo, students understand the basics of algorithms, and with Python, they apply this knowledge to more complex and broader areas. This approach ensures gradual and purposeful development in the educational system, developing students' rational thinking and analytical analysis abilities (Humbataliyev, 2018, p.90; Humbataliyev, Mirzoyeva, Jalilova, 2019, p.165; Ahmedov, İsmayılova, Humbataliyev, 2019, p.83).

The parallel use of these two languages in educational systems ensures the gradual development of students' programming skills and increasing their creativity and innovation abilities. This approach also provides solid preparation for modern topics such as technological literacy and the application of artificial intelligence. With this kind of systematic education, students acquire more independent thinking and problem-solving skills, thus gaining a solid foundation for their future success in their fields of study.

As a result, the combined application of Python and AlpLogo in education allows students to develop gradually and step by step in the world of programming. This approach also provides practical knowledge and experience that will ensure that students will be successful in technological professions in the future. The use of these two programming environments in education will remain an effective and purposeful method for training future programmers and technology professionals.

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Received: 02.02.2025

Accepted: 15.05.2025