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Visibility of Programming Languages in Turkish Universities: An Analysis of Bologna Information Packages

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Abstract: As of June 2025, the course contents published in the YÖK (Council of Higher Education) Bologna Information Packages of 1,128 information technology–related departments in Türkiye were systematically examined to identify programming language references within the curricula. A total of 3,990 individual course records were analyzed, revealing that the most frequently represented languages are C (574; 14.4%) and Python (543; 13.6%), followed by SQL (363; 9.1%), MATLAB (345; 8.6%), Java (342; 8.6%), and C++ (338; 8.5%). In course contents related to web technologies, HTML (256; 6.4%), CSS (230; 5.8%), and JavaScript (207; 5.2%) appear at moderate levels, while contemporary languages such as Kotlin (7), Swift (5), Go (3), and Rust (2) collectively account for only 0.4% of all references. These findings indicate that curricula in Türkiye remain predominantly focused on traditional languages, with data- and computation-oriented languages maintaining a strong presence, whereas modern and emerging languages are still marginally represented. Comparative European-level studies, including ESSA–CEDEFOP and GitHub Octoverse reports, similarly show that Python, Java, JavaScript, SQL, C++, and C# are among the most demanded technologies in the industry. These results underline the need to strengthen the alignment between academia and industry by allocating greater curricular space to contemporary languages and ensuring a more balanced integration of modern web and application development components.

Keywords: Bologna Information Package; Programming Languages; Curriculum Analysis; Universities in Türkiye

Türk Üniversitelerinde Programlama Dillerinin Görünürlüğü: Bologna Bilgi Paketlerinin Analizi

Öz: Haziran 2025 itibarıyla, Türkiye'deki 1.128 bilgi teknolojisiyle ilişkili bölümün YÖK (Yükseköğretim Kurulu) Bologna Bilgi Paketlerinde yayımlanan ders içerikleri incelenmiş ve müfredatlar içinde yer alan programlama dili atıfları sistematik olarak analiz edilmiştir. Toplam 3.990 ders kaydı değerlendirilmiş olup, en sık temsil edilen dillerin C (574; %14,4) ve Python (543; %13,6) olduğu belirlenmiştir. Bunları sırasıyla SQL (363; %9,1), MATLAB (345; %8,6), Java (342; %8,6) ve C++ (338; %8,5) izlemiştir. Web teknolojileriyle ilgili ders içeriklerinde HTML (256; %6,4), CSS (230; %5,8) ve JavaScript (207; %5,2) orta düzeyde temsil edilirken, Kotlin (7), Swift (5), Go (3) ve Rust (2) gibi çağdaş programlama dilleri toplamda yalnızca %0,4 oranında yer almıştır. Bulgular, Türkiye'deki müfredatların hâlâ ağırlıklı olarak geleneksel dillere dayandığını, veri ve hesaplama odaklı dillerin güçlü konumunu koruduğunu, buna karşın modern ve yeni nesil dillerin oldukça sınırlı biçimde temsil edildiğini göstermektedir. ESSA–CEDEFOP ve GitHub Octoverse gibi Avrupa düzeyindeki çalışmalar da benzer şekilde Python, Java, JavaScript, SQL, C++ ve C# dillerinin sektörde en fazla talep gören teknolojiler arasında olduğunu ortaya koymaktadır. Bu sonuçlar, akademi ile sanayi arasındaki uyumun güçlendirilmesi, çağdaş dillere müfredatta daha fazla yer verilmesi ve modern web/uygulama geliştirme bileşenlerinin daha dengeli biçimde bütünleştirilmesi gerekliliğini vurgulamaktadır.

Anahtar Kelimeler: Bologna Bilgi Paketi; Programlama Dilleri; Müfredat Analizi; Türkiye Üniversiteleri

1. Introduction

The rapid advancement of information and communication technologies has positioned software development at the core of global strategies, both economically and technologically. In this context, programming languages play a decisive role not only in academic curricula but also in practical applications. However, the existing “mismatch in language preferences” between academia and industry constitutes a significant barrier in terms of digital skills and employability.

In the case of Türkiye, this study examined 1,128 information technology-related departments as of June 2025, analyzing a total of 3,990 course contents. The findings indicate that the most frequently represented programming languages in curricula are C (574; 14.4%) and Python (543; 13.6%), followed by SQL, MATLAB, Java, and C++, all of which are primarily data- and computation-oriented. Conversely, modern languages such as Kotlin, Swift, Go, and Rust account for only 0.4% of the total representation, clearly revealing the limited integration of contemporary programming languages in Türkiye’s computing education.

Similar tendencies are evident in the European context. The ESSA–CEDEFOP (2020–2025) project, supported by the European Commission, highlights Java, JavaScript, SQL, HTML, PHP, C++, C#, and Python as the most demanded languages by industry and public institutions [1]. Likewise, the DevStyler (2024) report demonstrates that Python dominates in data science, machine learning, and automation; JavaScript leads in web development; Java is widely adopted in enterprise and Android applications; while C# maintains dominance in gaming and Microsoft ecosystems [2]. In addition, SQL, PHP, and Ruby continue to receive considerable demand in certain sectors. GitMax [3] also lists Python, JavaScript, Java, C#, C++, and PHP as the six most popular languages across Europe, emphasizing their continued strength in both traditional and modern systems.

From a global perspective, the GitHub Octoverse [4] report reveals that Python has surpassed JavaScript to become the most widely used programming language, primarily due to its central role in artificial intelligence, data science, and the Jupyter Notebook ecosystem. The report also indicates ongoing usage of TypeScript, Java, C#, C++, PHP, Shell, C, and Go, while Rust has shown a noteworthy increase in adoption within system programming. Similarly, the TIOBE Index (August 2025) places Python (26.14%) at the top, followed by C (9.03%), C++ (9.18%), Java (8.59%), C# (5.52%), JavaScript (3.15%), and Go (2.11%), reaffirming the global persistence of traditional language preferences [5].

The DevJobsScanner [6] analysis of job postings between January 2023 and September 2024 further supports these findings: JavaScript/TypeScript accounted for approximately 31% of all postings in Europe, followed by Python at 20%. Other prominent languages in development environments included Java (18%), C# (12%), PHP (~10%), along with C/C++ and Ruby. Additionally, the GitHub Octoverse [4] report highlights Rust as a rapidly rising system language, particularly in new technology domains.

Taken together, these results reveal a similar pattern across both Türkiye and Europe: traditional languages remain dominant, while modern languages are still marginal. Therefore, updating curricula, enriching them with programming languages relevant to emerging technological domains, and fostering stronger university–industry collaboration appear essential to address this gap. Similar studies conducted in Türkiye have also highlighted the need for curriculum modernization in engineering education [7-8].

2. Material and Method

This research was conducted to identify the distribution of programming languages included in the course contents of undergraduate programs related to information technologies in Turkish universities. The study was designed within the framework of a descriptive research method and employed the document analysis technique [9].

2.1. Data Source

The dataset was obtained from the Bologna Information Packages of the Council of Higher Education (YÖK) as of June 2025, based on updated course plans and syllabi. Across Türkiye, programs related to information technologies were reviewed, and a total of 1,128 departments were included within the scope of the study. These departments comprised Computer Engineering, Software Engineering, Management Information Systems, Information Technologies, and similar fields [10].

2.2. Data Collection Process

As illustrated in Figure 1, references to programming languages contained in the Bologna Information Packages were systematically examined and recorded. In cases where a course syllabus included more than one programming language, each language was treated as a separate entry. The data obtained from all departments were compiled into an Excel file, as shown in Figure 2, and a total of 3,990 records were included in the analysis [11].

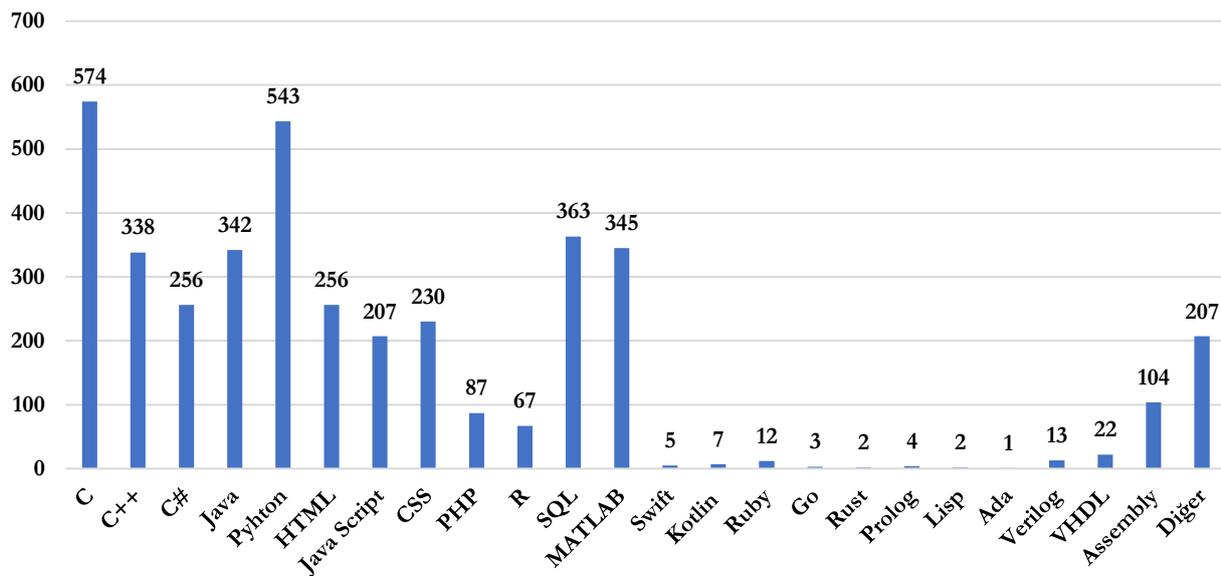


Figure 3. Programming languages offered in related departments of universities in Türkiye

The study also reveals a noticeable representation of web-based programming languages. In particular, HTML (256; 6.4%), CSS (230; 5.8%), and JavaScript (207; 5.2%) stand out as essential components of web technologies courses in information technology departments. On the other hand, PHP (87; 2.2%), another key language in the web ecosystem, is represented at a relatively lower level. This overall pattern suggests that while web development courses remain present in the curricula, they are comparatively less emphasized than core programming languages.

In recent years, contemporary programming languages such as Kotlin (7), Swift (5), Go (3), and Rust (2) have begun to gain wider adoption globally; however, their presence in computing curricula in Türkiye remains extremely limited. The combined representation of these four languages accounts for only 0.4% of the total. This finding indicates a significant deficiency in the integration of modern software development paradigms into university curricula.

The study also identified a low level of representation for other languages, including Assembly (104; 2.6%), R (67; 1.7%), VHDL (22; 0.6%), Verilog (13; 0.3%), Ruby (12; 0.3%), Prolog (4; 0.1%), Lisp (2; 0.05%), and Ada (1; 0.02%). Most of these languages are used in specific domains such as embedded systems, academic research, or logical programming, and therefore appear only in a limited number of courses.

Overall, the findings reveal that course contents in information technology departments in Türkiye are still predominantly based on traditional languages. In particular, C, Java, and C++ continue to serve as the primary tools for teaching fundamental programming skills in engineering-oriented departments, while Python has been widely adopted across diverse disciplines, including both engineering and management information systems. In contrast, the limited representation of contemporary languages stands out as a noteworthy gap when compared with recent reports at the European and global levels [4, 6, 14]. These reports highlight the growing adoption of modern languages such as Rust, Go, and Kotlin, especially in areas such as artificial intelligence, data science, mobile development, and cloud-based applications. Consequently, the minimal integration of these languages into Turkish curricula may be considered a substantial shortcoming in terms of alignment with international technological trends.

4. Discussion

This research, based on the analysis of course contents from 1,128 information technology-related departments in Türkiye, has revealed the distribution of programming languages within university curricula. The findings demonstrate that traditional programming languages (C, Java, C++, C#) continue to be predominantly utilized, while Python has achieved a strong interdisciplinary position, being widely adopted in both engineering and management information systems. In contrast, the representation of contemporary languages (Kotlin, Swift, Go, Rust) remains notably limited.

Comparable trends have been reported at the European level. The ESSA–CEDEFOP project and other recent reports emphasize that Java, JavaScript, SQL, C++, C#, and Python remain at the forefront in terms of industry demand [14]. The GitHub Octoverse [4] report further supports these results, highlighting that Python has surpassed JavaScript globally to become the most popular language [15]. Nevertheless, the increasing demand for modern languages such as Rust, Go, and Kotlin in Europe contrasts with their near absence in Turkish curricula. Although the level of awareness regarding these languages within the Turkish industry may still be limited, global reports underline the importance of updating curricula not only to address existing sectoral requirements but also to reflect emerging technological trends [16].

In this regard, it is essential to revise the course contents of computing programs in Türkiye in alignment with global technological developments. In particular, the inclusion of contemporary languages associated with artificial intelligence, big data, blockchain, mobile applications, and cloud computing would enhance students' adaptability to the future software ecosystem. Moreover, while web technologies continue to maintain their presence at a basic level, there is a growing need for curricular content that incorporates modern frameworks and languages (e.g., TypeScript).

5. Conclusion

In conclusion, this study has comprehensively revealed the programming language preferences of information technology-related departments in Türkiye through an examination of Bologna Information Packages. The results confirm that traditional languages (C, Java, C++) remain dominant, Python holds a strong interdisciplinary position, and modern languages (Kotlin, Swift, Go, Rust) are represented at a minimal level. These findings highlight the necessity of restructuring curricula to achieve a more balanced distribution of programming languages. Expanding the presence of contemporary languages and modern web/application development tools would enable students to better follow evolving trends in the software ecosystem and improve their preparedness for future professional demands.

Conflict of Interest

The authors declare that they have no competing interests.

Ethics Committee Approval

Ethics committee approval is not required.

Author Contribution

This manuscript is written by single author.

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