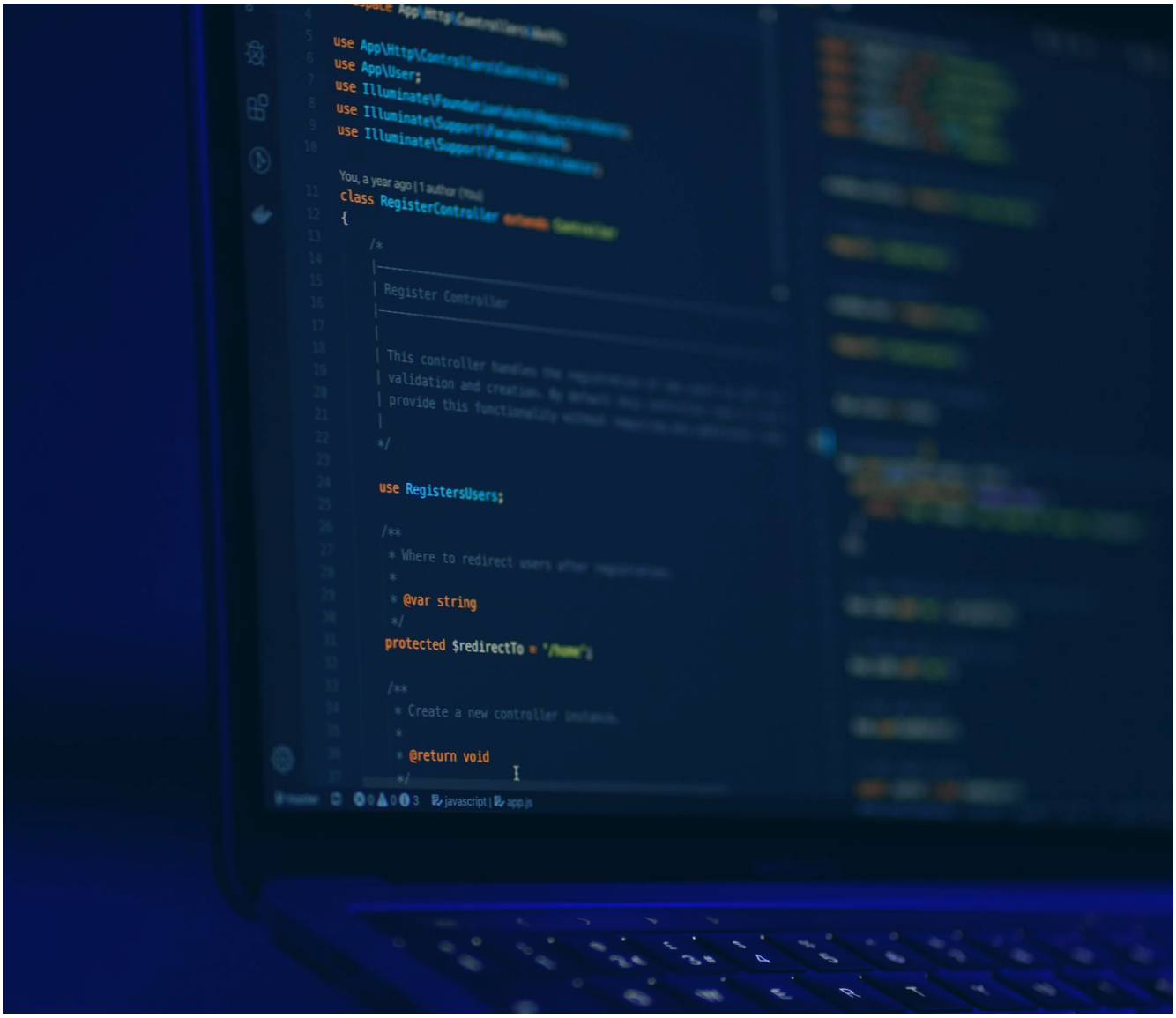
ICT

Sector Focus



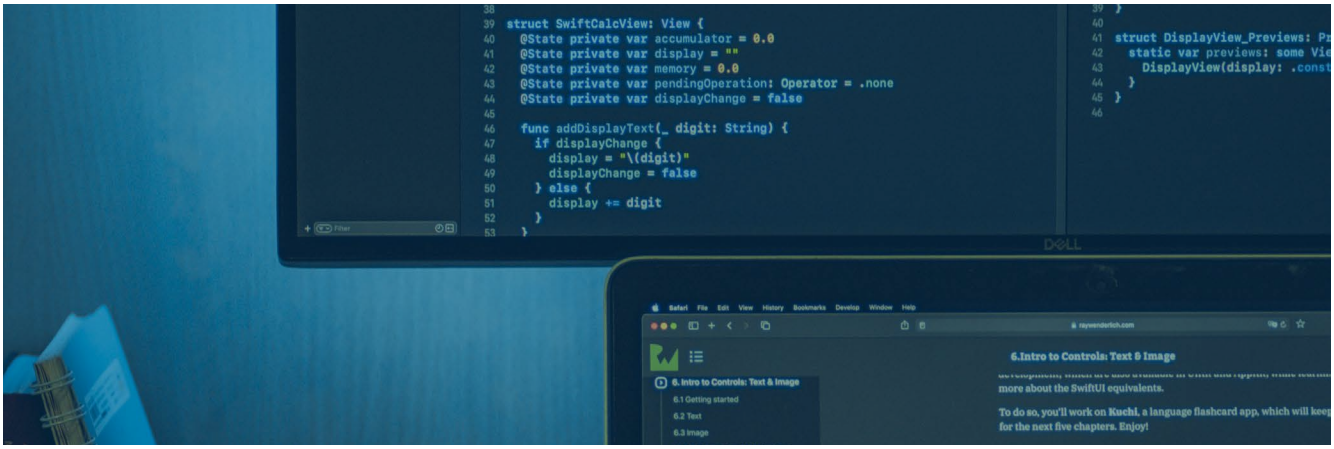
Programming

2022

Ajuntament de Barcelona

Barcelona Activa

Summary



Understanding and learning to programme

One of the defining features of the labour market today is the **high demand for digital profiles**. Digitisation is a necessary process for companies in the context of the fourth industrial revolution, and this has led to a massive growth of the number of professionals required, to an extent that the demand is above the capacity for generating talent. According to Barcelona Digital Talent, it is estimated that 350,000 ICT specialists are missing in Europe, 75,000 of which are needed in Spain.

In this situation, it is not surprising that many people who want to enter the labour market or make a career shift are looking for an opportunity in the ICT sector. Without specific training or prior experience in the sector, however, the **acquisition of digital skills becomes a barrier** that deters many people from taking this step. Fortunately, there is an increasing number of resources and training that do not require prior knowledge, and many of them have a common objective: **learning how to programme.**

Now... what does programming mean? Programming is actually a very generic term referring to the series of numerical or alphabetical codes that are used to give instructions to a machine to complete a particular task. In the early 20th century, these instructions were transferred to machines using punched paper strips. Later, in the 1950s, the first modern programming languages appeared and during the 1980s and 1990s many of the most widespread languages were developed today, such as **C++**, **Python**, **JAVA**, **JavaScript**, **Python** or **PHP**.

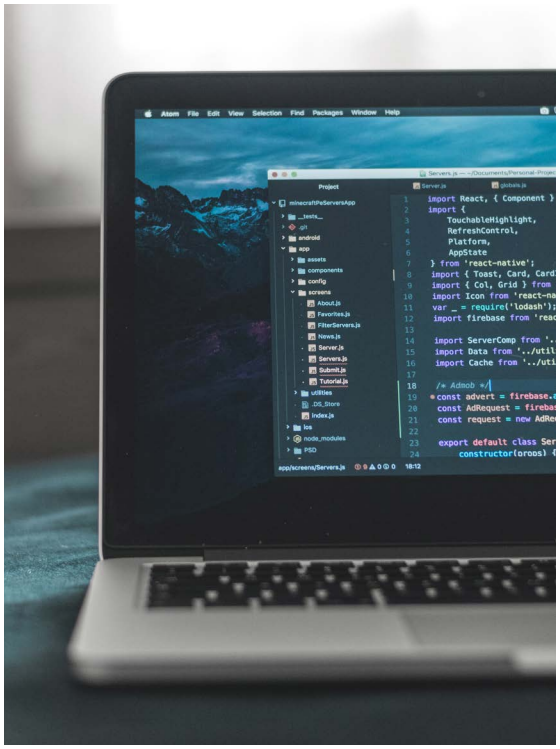
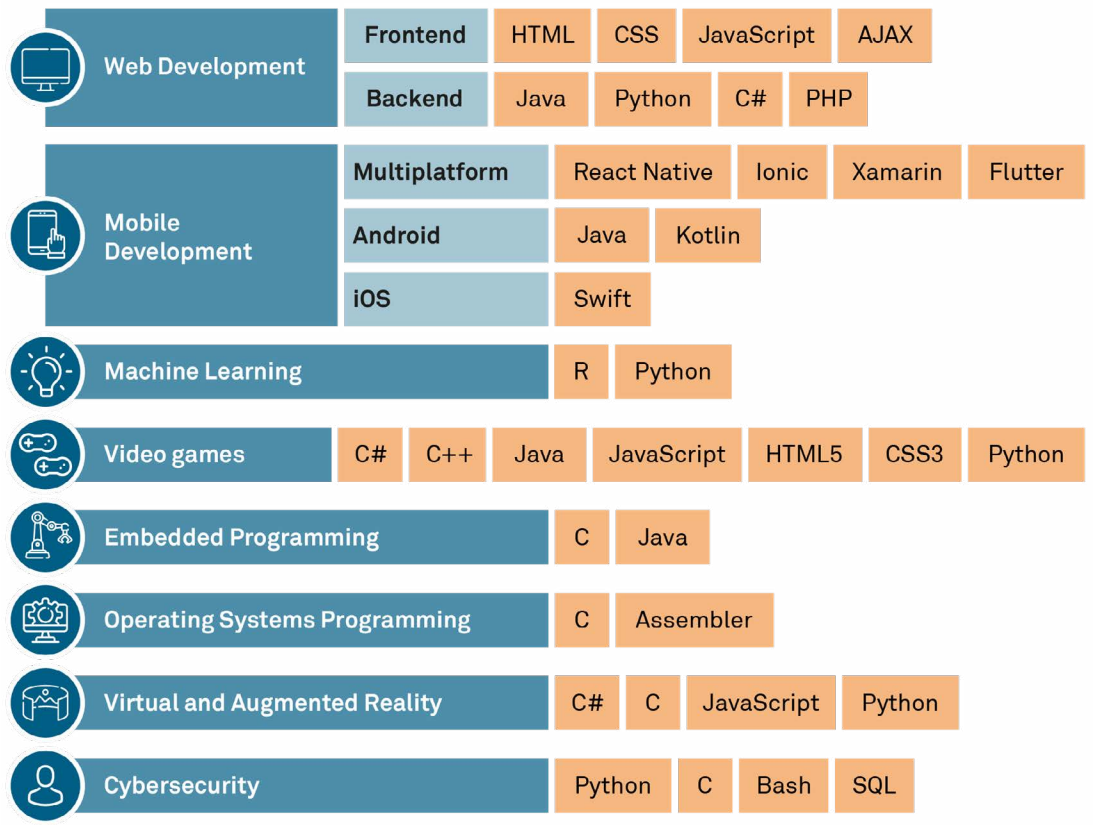


Figure 1. The most-used programming languages in different areas



Source: Prepared by the authors based on data from the paper Cuáles son las ramas de la programación, by Marcos Della Pittima

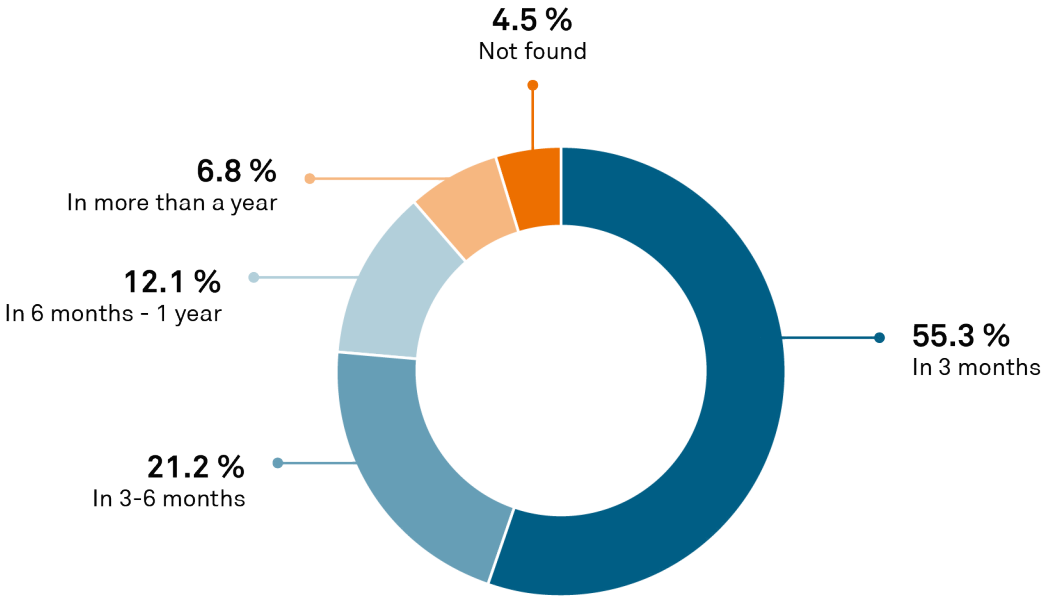
Returning to the definition of programming, we could say that, in the same way that communication exists throughout the world, but not everyone speaks the same language, programming is applied in many fields, but **each speciality has one or more predominant programming languages.** So one good way to get into the programming world is to ask: in what area do I want to work and what are the most commonly used or languages in that area?

Faced with a shortage of programming professionals, **new solutions have emerged aimed at shortening the training time required** to access jobs of this nature and thus closing the current gap between the supply and demand of programmers. In this sense, the most notable trends are bootcamps and low-code programming.

Bootcamps are short-term programmes that are presented as an alternative to traditional training in technological disciplines, such as undergraduate and master's degrees or vocational training. Generally speaking, these are courses lasting less than six months, with a **very practical learning methodology** and focused on developing specific digital skills, with the aim of achieving high employability (according to the Talent and Bootcamps report, 77% of those trained in bootcamps find employment in the ICT sector within six months).

Although bootcamps arrived in Spain in 2013, 86% of the courses were created between 2017 and 2022 -**and Barcelona has 41% of the offer across Spain. Web Development** is the most popular discipline in such trainings (offered at 89% of centres), followed by **Data Science/ Machine Learning** (50%). **JavaScript** (86%), **HTML** (79%) and **Python** (57%) are the most widely taught programming languages.

Figure 2. Job placement of bootcamp-trained professionals by time period (2020 data)



Source: Report Talent and Bootcamps, by Barcelona Digital Talent.

The second notable trend concerns the transformation of programming platforms into a more accessible and intuitive model. Thus, **low-code technologies** are those that allow programming with little code via visual interfaces with preconfigured components. Their main advantage is the **minimisation of the manual coding** needed to develop software applications, which translates into time and cost savings, as well as a reduction in the necessary training of equipment dedicated to the creation and maintenance of such applications.

To this day, low-code technologies still have a **low level of implementation in the market** due primarily to ignorance, opposition to change and a shortage of professionals who can accompany companies in the migration processes towards these technologies. In the future, however, low-code can be the key to making programming available to non-expert profiles and thus closing the digital talent gap.

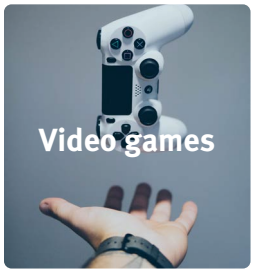
An essential skill beyond the ICT sector

The high demand for digital profiles and, in particular, for programming professionals can be attributed to the sum of two factors. The first, as was anticipated at the start of the report, is **the digitisation process of the economy**, which has accelerated due to the COVID-19 pandemic. The report The Future of Jobs by the World Economic Forum explains that, in Spain, 92.9% of managers interviewed claimed to be speeding up the digitisation of tasks in their company (by means of digital tools, videoconferencing, etc.) and 85.7% offered more opportunities for working from home since lockdown.

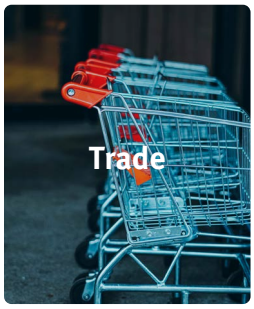
All of this implies a need to recruit **staff who can start and maintain these business digital environments**. For this reason, among the 10 positions that are growing the most according to the same report, there are Internet of Things specialists, machine learning specialists and software and application developers, jobs in which programming is an indispensable skill.

The second factor behind the high demand for programmers is the fact that these professionals are needed in a wide variety of economic activity areas, beyond the ICT sector. In fact, according to the Digital Talent Overview 2022 study, **only 15.1% of digital professionals in the province of Barcelona work in the ICT sector.** The rest is distributed in areas such as Business Services (20.4%), Consumer Services (6.9%), Construction and Maintenance (6.7%), Medical Care (6.1%) or the media (5.5%), among many others.

From the small business that wants to start selling online to large corporations that need specialised software to optimise their operations, more and more companies require programming services. Here are some examples of the role of **programming outside of strictly technological environments.**



Video game design is a process involving many professionals in the creative industry. They are responsible for defining the game's storyline, as well as the environment where it will take place, designing characters and actions, etc. Behind all this, however, programming is what **makes interactivity possible**, i.e., translates the player's commands into the actions shown on the screen.



Changing the habits of consumers drives businesses -even the smallest ones- to sell their products online. While there are platforms and plugins that allow online stores to run without programming knowledge, these tools are insufficient when transaction volume increases. The figure of the full-stack programmer is then necessary to build and maintain **e-commerce websites**, ensuring their proper functioning and compliance with security protocols.

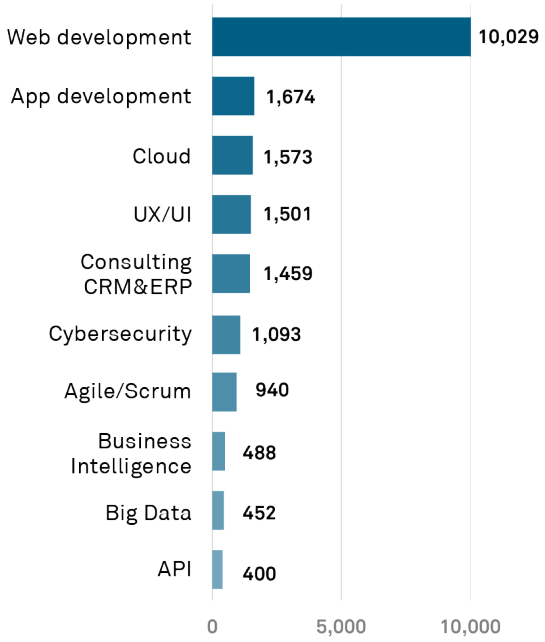
Due to digital transformation, more and more jobs are emerging within a company's usual structure that require programming skills. A clear example is companies that offer their services via websites or mobile apps and therefore have developers' teams on their staff. However, other **data analysis** professionals, **business analysis** and **cybersecurity** must also have notions of some programming languages, such as SQL or Python.

Programming in the job market

At present, the ICT sector is one of the main generators of employment opportunities worldwide, but also locally. According to the report Digital Talent Overview 2022, in 2021, more than 24,600 digital work offers were published and more than 9,400 professionals were incorporated into the sector in Barcelona only. Of all these offers, a significant portion corresponds to **jobs where programming is an essential or highly valued skill**, such as web and app development, cybersecurity or Big Data.

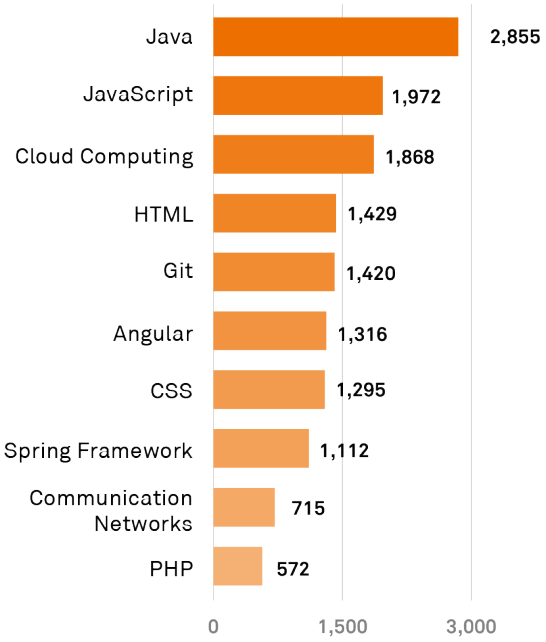
Regarding the Spanish State as a whole, the Telefónica Foundation's Map of Employment points out that the programming languages **Java, JavaScript, HTML, CSS and PHP are among the 10 most sought-after skills** in digital job offers.

Figure 3. Demand for talent in well-established technologies in Barcelona (annualised job offers based on a three-month period in 2021)



Source: Prepared by the authors, based on data from Digital Talent Overview 2022, by Barcelona Digital Talent

Figure 4. The 10 most in-demand digital skills in Spain (number of job offers, March-June 2022)



Source: Prepared by the authors, based on data from Mapa del Empleo, by Fundación Telefónica

These two graphs are useful for making an important point: although the terms "programmer" or "computer technician" are often used generically to refer to people working with code, **"programming" is a technical skill, not a profession.** The reality in the labour market is more complex, as there is a wide variety of professional profiles specialised in different tasks for which programming is a central skill. Some of the **most sought-after jobs** are defined below:

Computer Programmer: It is a cross-cutting profile that creates software, web pages and applications and ensures that they work properly. In addition to writing code, they also conduct tests to detect errors and correct them with the aim of improving programmes that have already been developed.

Web Programmer: They use programming for creating and maintaining web pages and applications. They may specialise in frontend or backend, or master both areas and work as full-stack developers.

- **Frontend Developer:** A professional who builds the parts of the websites and applications that the users see and interact with. They include design principles for websites to function and display properly on different devices, monitor their performance, review usability, and fix code errors.
- **Backend Developer:** Unlike frontend developers, they work with the part of the pages and web applications that is not visible to users (the server). Some of their functions are data management, encryption and storage.
- **Full-stack Developer:** These professionals work with both the frontend and the backend of websites.

Software Developer: They participate in the creation of software from beginning to end and software optimisation for various uses and needs of users.

System Analyst: They examine an organisation's IT systems and computers to propose recommendations that will improve its operation. They design solutions for problems and inefficiencies and assess the advisability of introducing new equipment and software.

System Engineer: These professionals work with software developers and other engineers to offer technical support and maintenance of an organisation's computer systems.

Network Administrator: A network system administrator manages a company's servers, computer equipment, local networks and intranet. They maintain both the hardware and the software used in an organisation's computer network for the company to function effectively.

Database Administrator: They determine the storage and management needs of an organisation, integrate databases and work towards making them easy to access and manage.

Finally, programming **is not an exclusive skill of ICT sector profiles**. In an increasingly digital world, many professionals can benefit from acquiring basic programming skills applied to their specialty. Below are three examples:

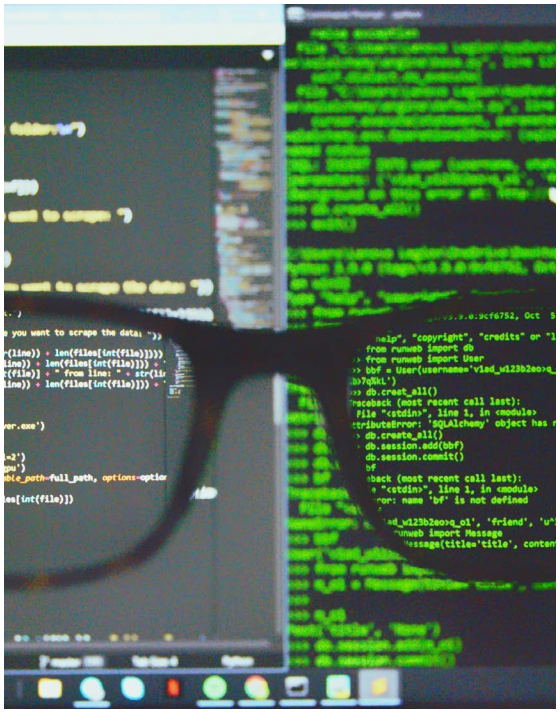
UI Specialists and UX Specialists: These professionals work together with web and app developers. While it is not essential that people dedicated to UX/UI design know how to programme, having notions of HTML and CSS is useful for understanding the advantages and limitations of implementing their designs. That is why programming is a well-valued skill in this area.

Researchers: Research projects involving the collection and analysis of quantitative data are carried out in all fields of knowledge. In this context, it is common to use R, a programming language for statistical computing, to create models and simulations from real data.

Web Analytics Expert: They are responsible for collecting, analysing and summarising data extracted from the company's website, social networks and email. Beyond knowing how to use tools like Google Analytics, Kissmetrics, Heap or Mixpanel, it may be useful for these professionals to have knowledge of Javascript for visualisations.

A focus on programming

To sum up, programming is **one of the most valued skills** on the labour market today. On the one hand, it is a prerequisite in many ICT sector jobs; on the other, it brings added value to profiles in other sectors -such as marketing or design- working in digital environments. This is therefore an apprenticeship that can be **useful to many people**, both those who want to make progress in their career and for those who seek an entry door to the labour market for the first time or after a period of unemployment.



Due to the shortage of digital professionals that characterises the current job market, initiatives have emerged that facilitate this incorporation into the sector, **accelerating and making ICT qualification more accessible**. For example, bootcamps train people in specific digital skills with the aim of preparing them in a short time to find work in specific digital jobs, while low-code technologies simplify programming work.

Low-code and other technologies such as predictive programming (artificial intelligence applications that generate code from minimal human intervention) are still in an early stage. However, there are already voices predicting that these tools will be decisive in **closing the gap between supply and demand for digital professionals.** In other words, progress is being made towards a future in which programming will be a universal skill -but, for the moment, it is still necessary a necessary skill to access the ICT sector.

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