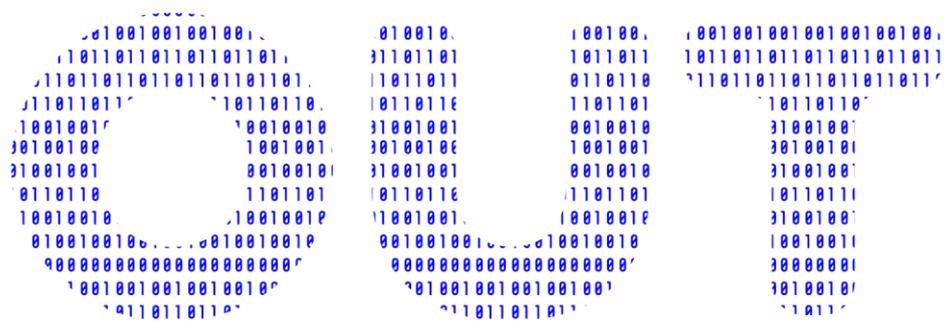


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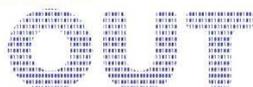
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for employment

BRIEF STATE OF THE ART ANALYSIS AND NEEDS ASSESSMENT



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Foreword

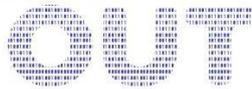
This brief State of the Art analysis was developed by IPS_Innovative Prison Systems and BSAFE LAB Law Enforcement, Justice and Public Safety Research and Technology Transfer Laboratory of UBI (University of Beira Interior), partners in the project Coding in prison as a valuable OUTside tool for employment – Coding-OUT – No. 2018-1-ES01-KA204-050720, financed by ERASMUS + programme.

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Coding-OUT project is co-financed by the European Commission under the “ERASMUS+ KA2 - Strategic Partnerships for Adult Education. Coding OUT brings together different institutions representing potential employers, research, training and consulting organisations, end-users (prisons or prison administrations) and international corrections (sectoral) organisations.

This report is divided in two chapters:

- Chapter I: were a brief theoretical literature was reviewed on the topics of coding and programming in prison, in order to capture an international image on the development of digital and coding skills within prison contexts, and its importance for recidivism reduction.
- Chapter II: were based on the findings of the brief State of the Art Analysis, a needs analysis was conducted to assess each partner country’s profile in this domain. Hence, questionnaires were developed to assess the needs of two target populations: employers and prison educators.

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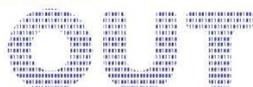
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May 2019



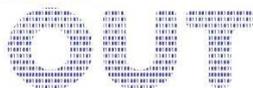
Chapter I: State of the Art

1. Introduction

The criminal recidivism is reported to be as high as 50% in many jurisdictions, and, unlike recorded crime rates in general population, did not decline in recent years (Fazel & Wolf, 2015). Often, this recidivism rate is related to the difficulty encountered by ex-inmates in re-integrating into society, since most of them face a range of social, economic and personal challenges that tend to become obstacles to a crime-free lifestyle (Borzycki & Baldry, 2003). The most usual obstacle is unemployment since it is frequently identified, by the released inmates, as one of the most important factors in their efforts to stay crime-free after incarceration (James, 2015).

There is a recognition that preparation for reintegration should start before the offenders' release, during the execution of the sentence (Griffiths, Dandurand, & Murdoch, 2007). Furthermore, it is well-known that inmates, who receive general education and vocational training, are less likely to return to prison after release, and more likely to find a job than others to whom such opportunities are not provided (Davis, Bozick, Steele, Saunders, & Miles, 2013; Torlone & Vryonides, 2016). Prison vocational training should address vital aspects of offenders' rehabilitation and reintegration (Lawrence, Mears, Dubin, & Travis, 2002), as well as granting them proper qualification, competencies and skills helping them in job finding and retention.

Nowadays, we live in a hyper-connected digital society, where we are surrounded by IT devices and software. Not having basic knowledge in this area represents a major challenge and is the equivalent of being illiterate a few years ago. Many inmates are released into society without having the digital skills they need, which hinders their ability to interact with modern public services, access basic services (such as education and health) or secure employment. Furthermore, inmates must be allowed to develop IT skills while serving their sentences (Kerr & Willis, 2018; Torlone & Vryonides, 2016). Since, coding helps practice 21-st century skills such as problem solving, teamwork and analytical thinking, coding represents an important tool that might increase inmates' chances of securing employment after their release from prison.



In fact, across Europe, there is an increasing need for workers who have relevant digital skills. Recent Eurostat statistics showed that almost 40% of the companies that are trying to recruit ICT professionals, in Europe, reported difficulties in finding a skilled workforce. This growing lack of digital skills in Europe is leading to an increasing shortage of ICT practitioners, that hinders not only economic growth, but also competitiveness and employment.

Two factors explain this European lack of ICT mastery: the first one is related to the fact that nowadays, Europe, is not producing enough ICT graduates and the second factor is that people who present ICT skills often do not keep up with the advance of technology and end up having outdated competencies (Council of European Professional Informatics Societies, 2014).

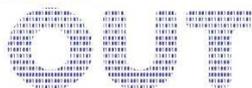
Despite the need to promote digital education in prisons, some problems in this domain usually arise. Particularly, we know that overall inmates find many barriers in the use of technology inside the prison (Farley, Pike, Demiray, & Tanglang, 2015; Kerr & Willis, 2018). For this reason, alternative ways to allow such learning without using the Internet access should be created. These alternatives, according to the authors, could, in fact be beneficial since the absence of online learning materials requires that students work together, and thus, it becomes a problem-solving activity (Nichols, 2018).

2. Coding Education

In recent years the demand for programmer's and student's interest in programming has grown rapidly, and introductory programming courses have become increasingly popular (Robins, Rountree, & Rountree, 2003).

Learning to code is hard since it requires focus on logic, creativity, reasoning, and problem-solving rather than learning the programming language itself. Moreover, some computing students who learn how to programme for the first time, often have ineffective mental models on how a programme operates and thus, they tend to fail to transfer their programming knowledge beyond what is taught. They usually lack appropriate cognitive skills, that are a prerequisite to learning computer programming, and frequently struggle when it comes to understand the abstract constructs involved. This has a direct impact on students not only because it may cause high levels of anxiety, but also it can create a fear in programming. Since performance is negatively affected by anxiety, this consequently impacts on their academic performance (Connolly, Murphy, & Moore, 2007).

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In this line of thought, developing learning strategies is crucial both for the traditional student, who enters higher education after finishing their second-level education, but also for those students re-entering the education systems, after being away from it for some time (Connolly et al, 2007).

On one hand, many educators would agree that the most effective form of teaching is through one-to-one interactions with students (Odekirk-Hash & Zachary, 2001). So, it is not surprising that an effective way to teach programming is to give students support in their reasoning and immediate feedback on the programs they create. On the other hand, programming education is motivated by engaging learners through gaming, storytelling, or “think like a computer” activities. The cognitive evaluation theory (Deci & Ryan, 1985) mentions that intrinsic motivation is the one that emerges spontaneously without the aid of external pressure and/or environmental control. With this principle in mind, some teaching techniques are based on the reward of accomplished activities and tasks. A tangible reward may promote not only the students’ confidence but also their feelings of competence and control, leading to increased intrinsic motivation. As the motivation and engagement are the cornerstones of education, the reward system may lead to a proficient students’ knowledge acquisition. Furthermore, gamification in the classroom has been also progressively adopted. Gamification may contribute to increase students’ engagement and promote personalised and self-paced learning. Also, gamification may empower teachers to provide a faster feedback on students’ activities. Incorporating the immediate and continuous feedback found in game design into teaching activities may enhance the teachers’ evaluation and feedback that, otherwise, are usually provided to one student at a time. Also, gamification may enable an effective tracking of students’ activities and their individual needs which may, in turn, result in an effective and timely guidance.

3. Coding in prisons

During past years, several projects have been designed to engage inmates in programming and software development. In 2014, an initiative called “Code.7370” was supported by the California Department of Corrections and Rehabilitation and the California Prison Industry Authority (CalPIA) aiming to promote a computer programming curriculum in San Quentin prison. The main purpose of this initiative is to empower prisoners with technology skills so they can improve their chances of employment upon release. This program was created under the umbrella of a project called “The Last Mile” oriented to

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promote the entrepreneurship and innovation among the inmates of San Quentin prison (<https://thelastmile.org>). Notably, 55 graduates of the programme in California have been successfully reintegrated into their communities upon release. Given the programme's success, in 2018, Google invested 2 million dollars to support the expansion of the initiative in the Midwest, namely at the Pendleton Juvenile Correction Facility, located at Indianapolis (<https://statescoop.com/google-the-last-mile-prison-coding-mc-hammer/>).

Likewise, in the US, a non-profit organisation named "*CodeOut*", based at Atlanta, aims to provide programming skills to women in Georgia's prison system. The organisation expects to reduce the rates of recidivism by promoting education in the technology space, namely programming (<https://www.codeout.org/>). Furthermore, the initiative entitled "*Code4000*" aims to replicate to the UK the same principles observed in the "*Code.7370*", implemented in the US (*Code 4000*).

Unfortunately, the available information related to these initiatives lacks detail on the syllabus adopted into the programming and software development courses.

Due to the heterogeneity of the prison population, the design of a programming training is challenging. On the one hand, the programme should contain enough coursework including the introductory, intermediate, or advanced levels based on the body of knowledge for computer science. In fact, programming is composed of technologies or activities for creating computer programmes that perform the desired function (Bourque & Fairley, 2014) which encompasses tasks such as designing, writing, testing, debugging, and maintain source code. Furthermore, these activities often require expertise in many different areas, including knowledge of application domain, data structures, algorithms, among others.

On the other hand, the participants must fit in the desirable competencies. According to the OECD (Swiss Federal Statistical Office, 2002), key competencies may be classified into three broad categories:

- Individual Competencies: to be able to interact with the environment (e.g., verbal and non-verbal communication; and job-specific competencies, such as IT-based language).
- Relational Competencies: to be able to engage with others and interact in heterogeneous groups.
- Autonomous Competencies: to manage own's life responsibility in the broader social context. However, within the context of prison, there's a loss of this concept.

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In these secure contexts, the inmates lose the ability to make basic decisions (i.e., inability to make choices regarding their food, movements and basic needs), since their lives are totally and minutely controlled by a vast array of rules not only imposed by the prison itself, but also by prison guards (Shammas, 2017; Huey, 2010). Still, within the self-determination theory (SDT), perceived afforded choice and autonomy are fundamental for individual's psychological functioning. Indeed, autonomy is considered a universal and crucial psychological need, since the satisfaction that arises from autonomy contributes to individuals' well-being and quality of life. Autonomy influences the sense of psychological freedom and self-endorsement when carrying out an activity (van der Kaap-Deeder et al., 2017).

Finally, the usual learning outcome in programming implies that at the end of the training the student should be able to apply concepts, models, and language adequate to problem resolution using a programming language.

With the coursework, and different levels and competences in mind, the following topics should be considered for adoption in programming courses:

- Programming foundations: it may include basic concepts, workflows, statements and expressions, conditional code, functions, and best practices in the context of a programming language (e.g. Java, Python, or C);
- Internet technologies: it may include foundations on HTML, CSS, PHP, and JavaScript;
- Mobile programming: it may include, above others, application models of mobile application frameworks, user-interface design, managing application data, and cloud services;
- Soft skills: it includes, above others, teamwork, communication, critical thinking, time management, and conflict management;

3.1. Prisoners' profile to accomplish the training

To effectively ensure that training will achieve the objectives proposed, care should be given to the definition of prerequisites of those who will be the target of training. In this sense, Lawrence et. al (2002) stated that pre-prison characteristics should be considered



namely: work experience, education level, health status, life skills, criminal record, and demographics. Despite this, the diversity of individuals' characteristics is noticeable (Rocha, 2016), and thus it becomes more complex to organise a group that follows a pattern. Previous literature emphasised the notion that the clarification of an adequate profile is complex given the offenders' dissimilarities in their characteristics (Torlone & Vryonides, 2016). Moreover, this difficulty of creating a profile is aggravated by the difficulty to define concretely the curriculum itself (Rocha, 2016). Indeed, lack of information exists about the skills inmates who will learn coding should have in order to facilitate the effectiveness of such learning. Regarding the work that has been done in prisons, some considerations have been emphasised to select the more adequate inmates. Lawrence et al. (2002) postulated that to be effective, the training information should be delivered to those who are close to releasing but that will detain enough time to complete at least an initial training.

As we mentioned before, little has been reported about the necessary skills that are needed to engage in vocational training (UNODC, 2017). In fact, a huge variety of approaches seem to exist. For example, in USA, different states consider different criteria for such admission. Some believed that to engage in vocational training (like coding and programming), inmates need to already possess a certain level of education (Lawrence et al., 2002). Previous studies noticed that, in general, this population presents several gaps in literacy, lack of motivation to learn, and little basic abilities (like participatory skills) (Rocha, 2016; Harlow, 2003; Hawley, Murphy, & Souto-Otero, 2013; Torlone & Vryonides, 2016; & United Nations Office on Drug and Crime, 2017). However, the same studies showed that a significant part of inmates affirmed to have some competence concerning ICT.

Even under these conditions, some efforts have been made to identify a set of criteria to facilitate the participants' selection process. Indeed, some practitioners have already defined concretely which criteria should be addressed to select participants. Rocha (2016), to select the inmates for a training programme in the domain of ICT focus on four main domains: (i) time until the end of sentence, which should be enough to evaluate the results; (ii) level of education, which should be at least the minimum; (iii) current engagement on school in prison, which is preferential; and (iv) level of proficiency in ICT, given priority to those who have poor skills.

Other authors consider that age is another important factor to contemplate since it could have a significant impact on the effectiveness of learning (Crime Solutions, n.d; UNODC, 2017).

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Moreover, related with the participants' selection for the vocational programmes, aspects, such as the size of the group to train, since this variable directly affects the possibilities to provide (or not) a deeper knowledge (UNODC, 2017).

Besides, the question that remains is related to the appropriateness of establishing the same objectives of learning for all students, or if should exist an adjustment to everyone's condition (UNODC, 2017).

Chapter II: Needs assessment

We conducted a needs assessment in order to identify the level of proficiency of both employers of IT sector and prison teachers and trainers, as well as their specific training needs. This analysis was developed with the intent to collect information about what are the main domains that require intervention and that should be addressed in the Coding-OUT training modules.

Data collection was achieved through the application of two different questionnaires (one for employers and one another for prison teachers and trainers). Both questionnaires are divided in two parts. The part A is related to the respondent's sociodemographic characteristics, while part B focuses on the needs assessment itself.

1. Employers' needs assessment

The Coding-OUT employers' questionnaire was applied to 36 specialists from different companies and countries.

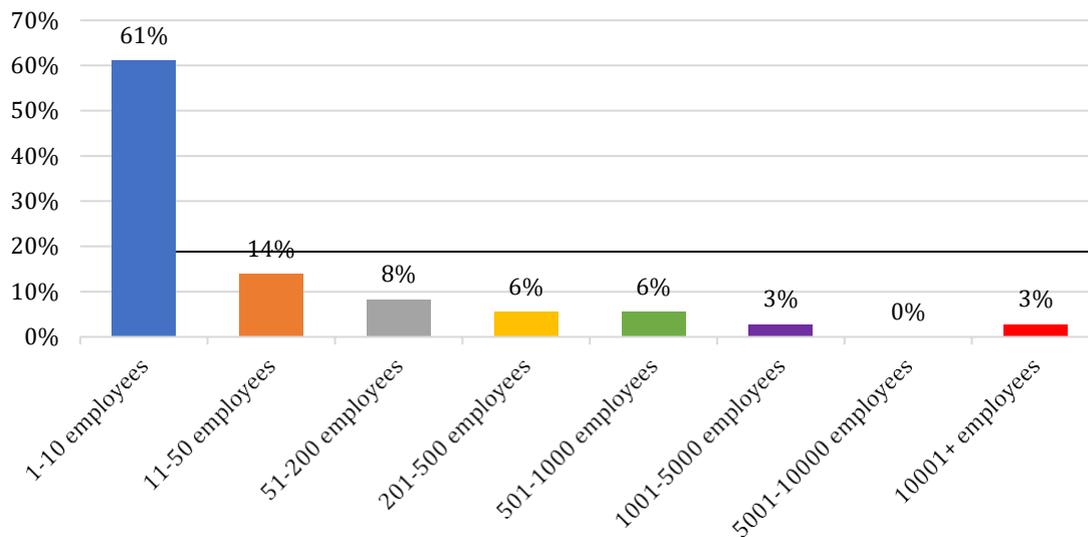
1.1. Summary of results:

Country

With the cooperation of the whole consortium, the questionnaire was distributed in different countries and companies.

Total number of participants: 36 organisations.

Number of Employees

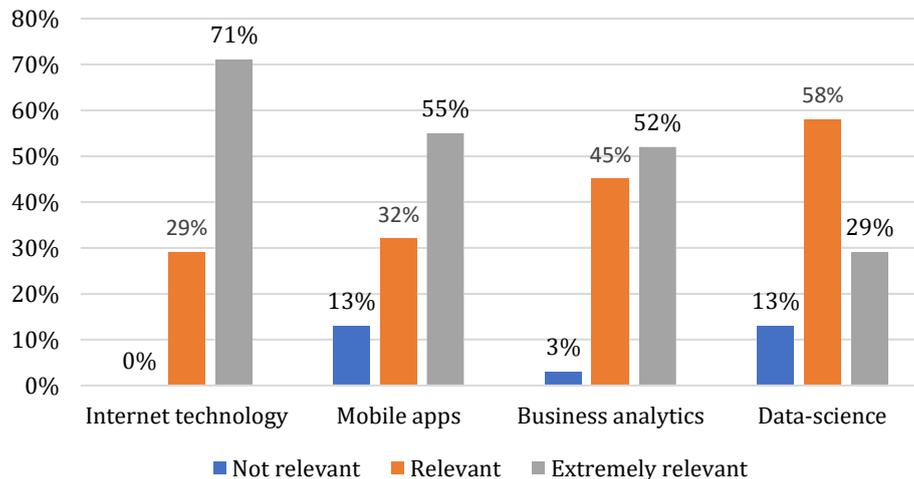


Knowledge requirements

Basic internet technology

Knowledge of internet technology, mobile apps, and business analytics were considered extremely relevant. Data-science knowledge is considered relevant.

Basic Internet Technology



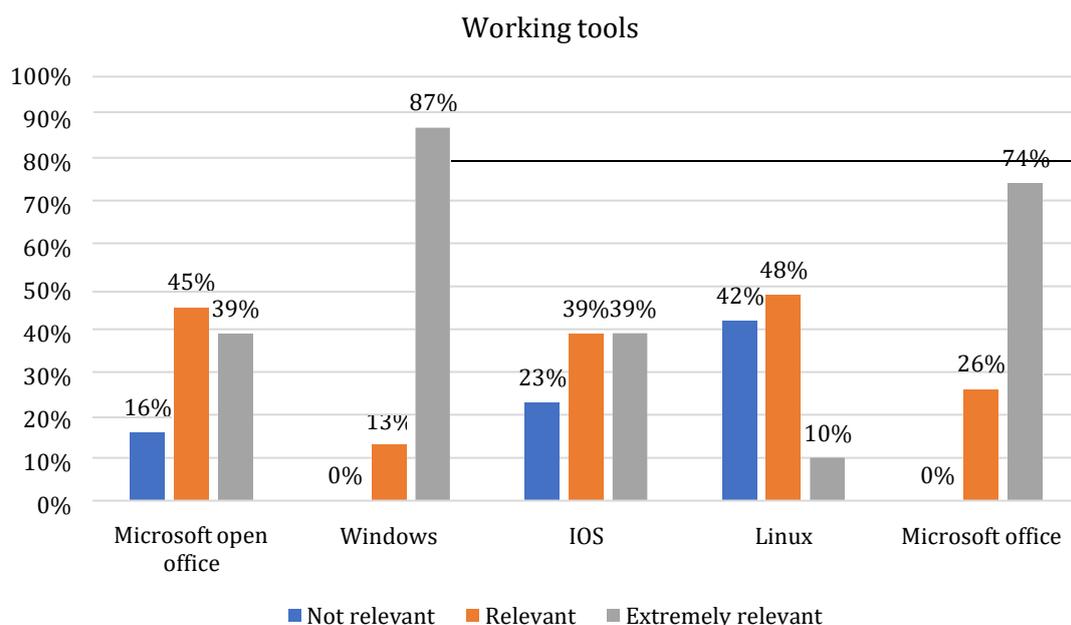
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Other knowledge considered interested are the following ones:

Other, please identify: 7/31	1. Artificial Intelligence; Visual Studio; Visual Studio Code
	2. Networks and network support
	3. Cloud
	4. Suite Office 365 - WEB (Teams, Sharepoint, among others)
	5. ERPs
	6. Big Data, IA
	7. SAP

Working tools

Knowledge of windows (87%), Microsoft office (74%) and web browsers (65%) were considered extremely relevant. Knowledge of Linux is considered relevant for 48% of the participants.

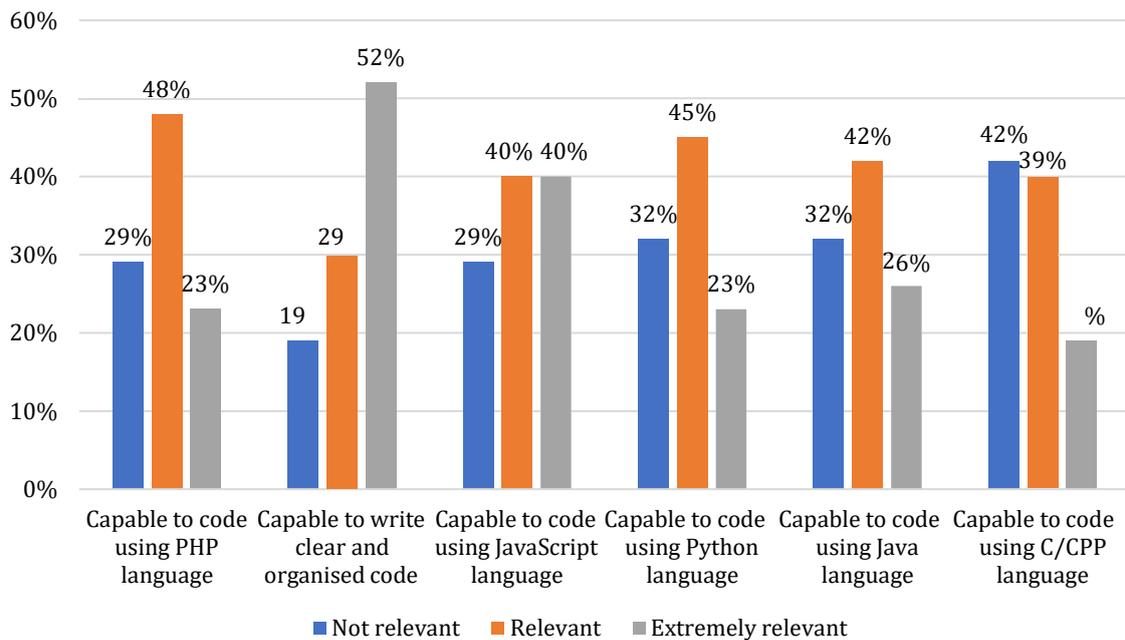


Writing code/Coding Language

“To be capable to write clear and organised code” was considered extremely relevant for the 52% of the participating companies, followed by being “capable to write code using PHP language”, which is considered relevant for the 48% of participants.

The rest of the possibilities have different considerations for the participants.

Writing code/Coding language



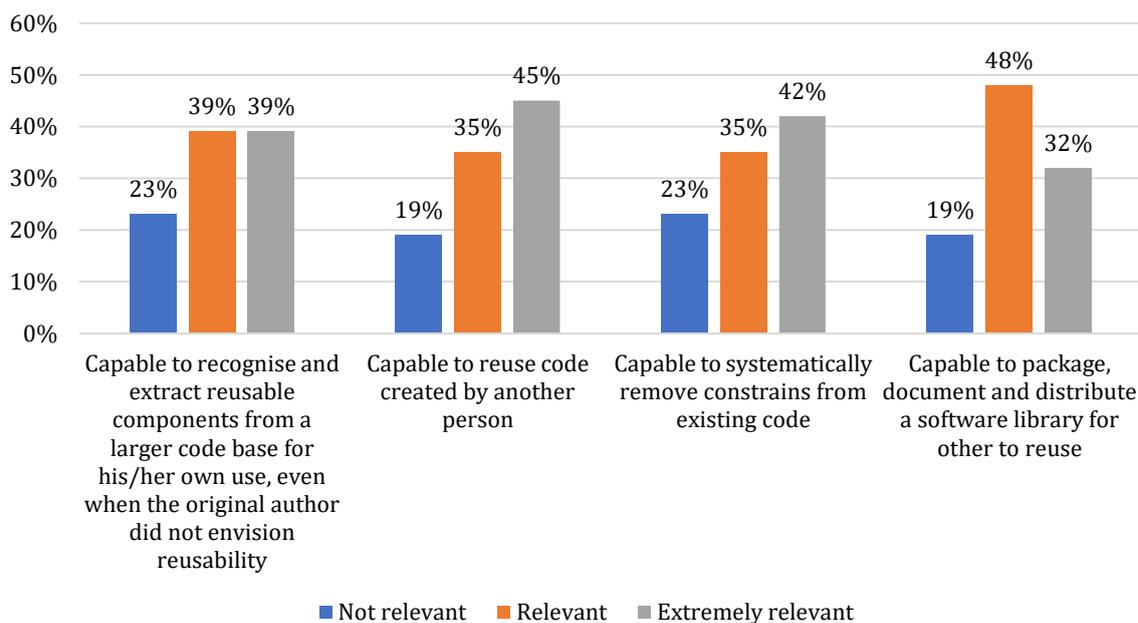
Reuse code

“To be capable of package, document and distribute a software library for others to reuse” was considered relevant for 48% of the participating companies, followed by being “capable to reuse code created by another person”, which was considered extremely relevant for the 45% of participants.

The rest of the possibilities had different considerations for the participants.



Reuse code

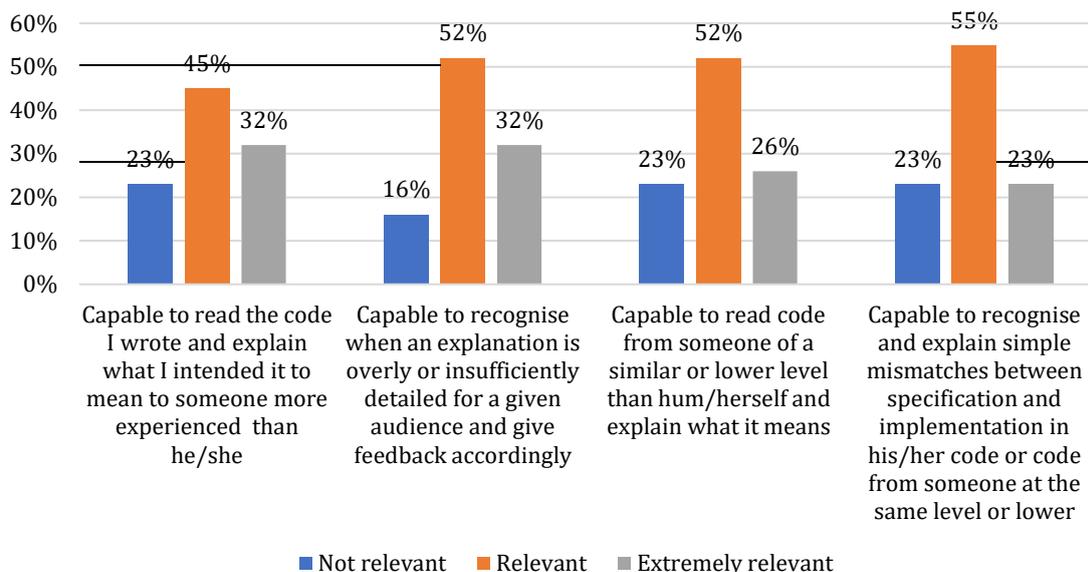


Explaining / Discussing code

All the options described in this area were considered relevant for the participants in the survey. “To be capable to recognise when an explanation is overly or insufficiently detailed for a given audience and give feedback accordingly” and “to be capable to read the code written by the person and explain what its intend to mean to someone more experienced” were the two aspects considered extremely relevant with the 32% of participants.



Explaining/Discussing code

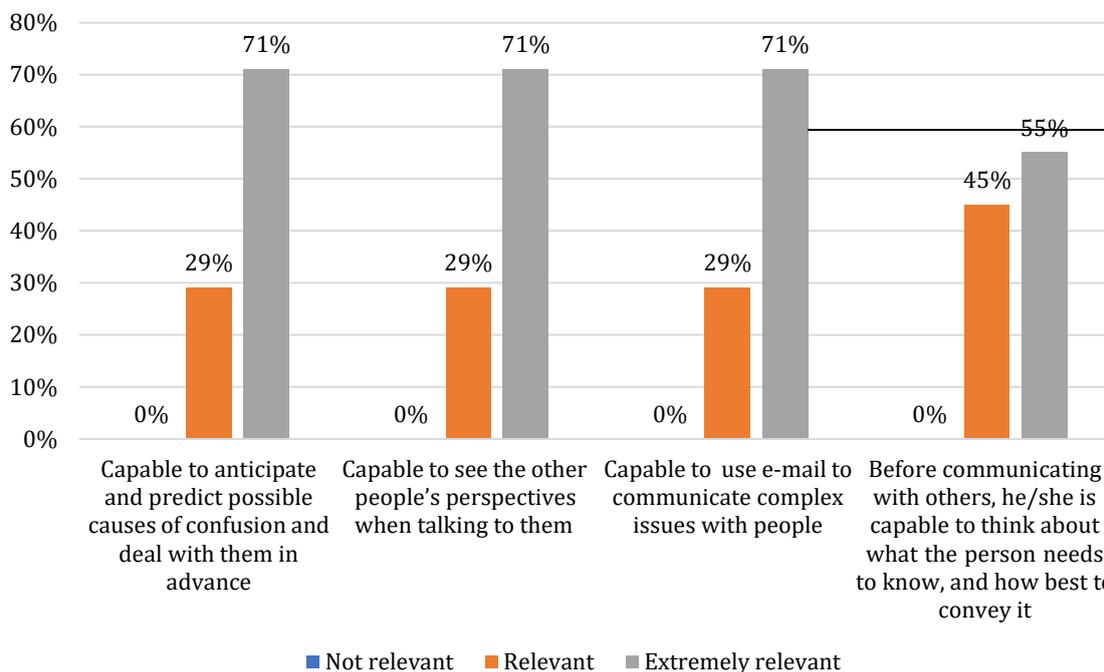


Communication skills

Almost all the aspects considered in communication skills have been considered relevant or extremely relevant. “To be capable to anticipate and predict possible causes of confusion and deal with them in advance”, “to be capable to see the other people’s perspectives when talking to them”, and “to be capable to use e-mail to communicate complex issues with people” were the most extremely relevant aspects for 71% of the participants.



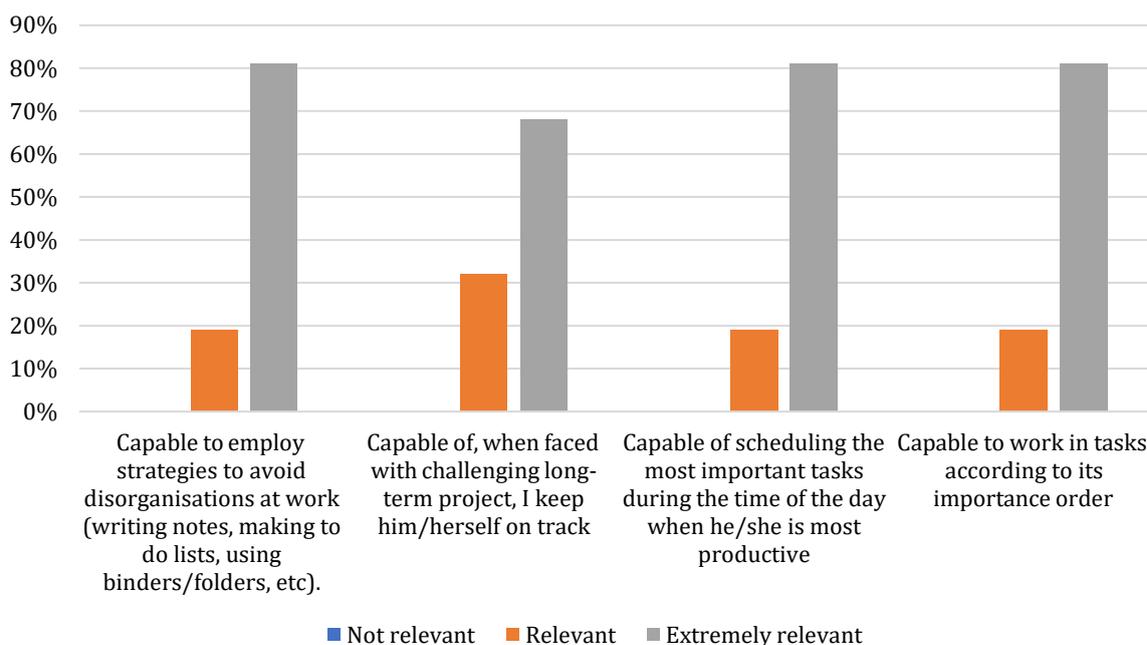
Communication skills



Organisational skills

All the aspects related to organisational skills have been considered extremely relevant for all participants.

Organisational skills

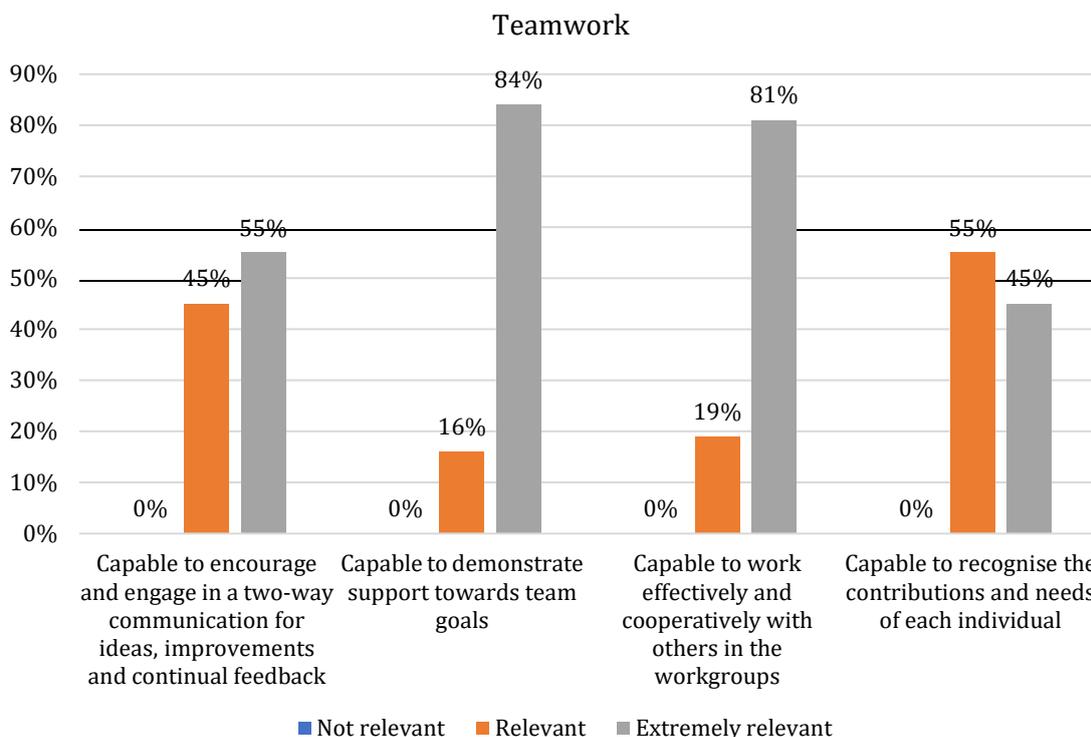


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Teamwork

All the aspects included in the teamwork section have been considered relevant or extremely relevant. “To be capable to demonstrate support towards team goals have been rated as extremely relevant by 84% of the participants”, followed by “being capable to work effectively and cooperatively with others in the workgroups” rated as extremely relevant by 81% of the participants.

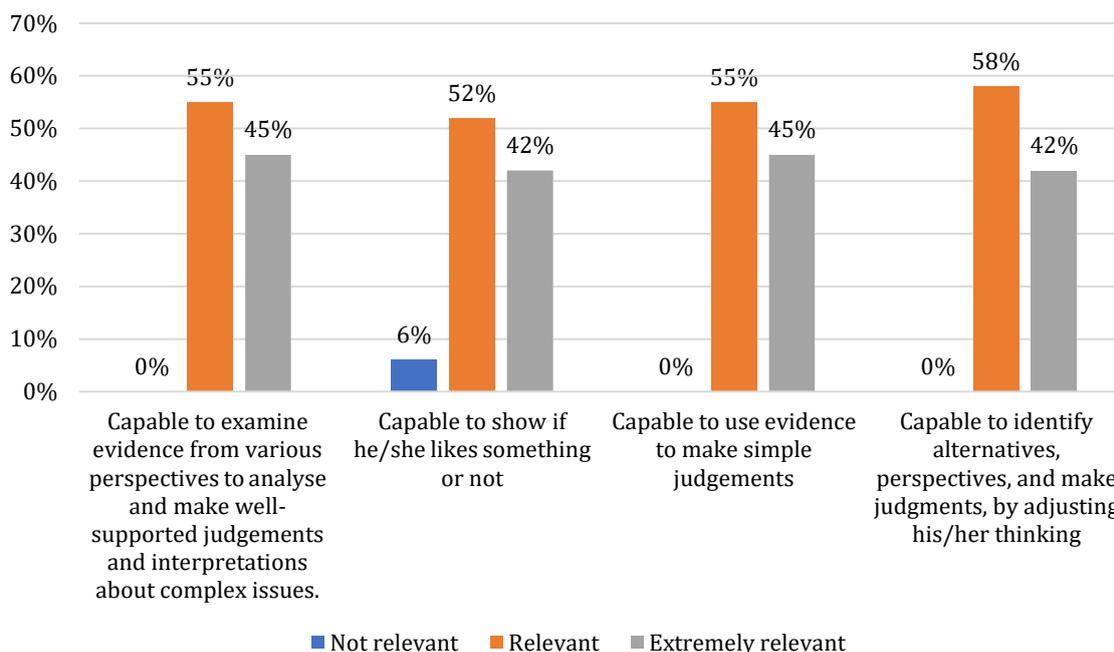


Critical thinking

All the aspects included in the critical thinking section have been considered relevant or extremely relevant. “To be capable to identify alternatives, perspectives and make judgments by adjusting his/her thinking” has been considered relevant by 58% of the participants, followed by being “capable to use evidence to make simple judgments and being capable to examine evidence from various perspectives”, which have been rated as relevant by 55% of the participants.



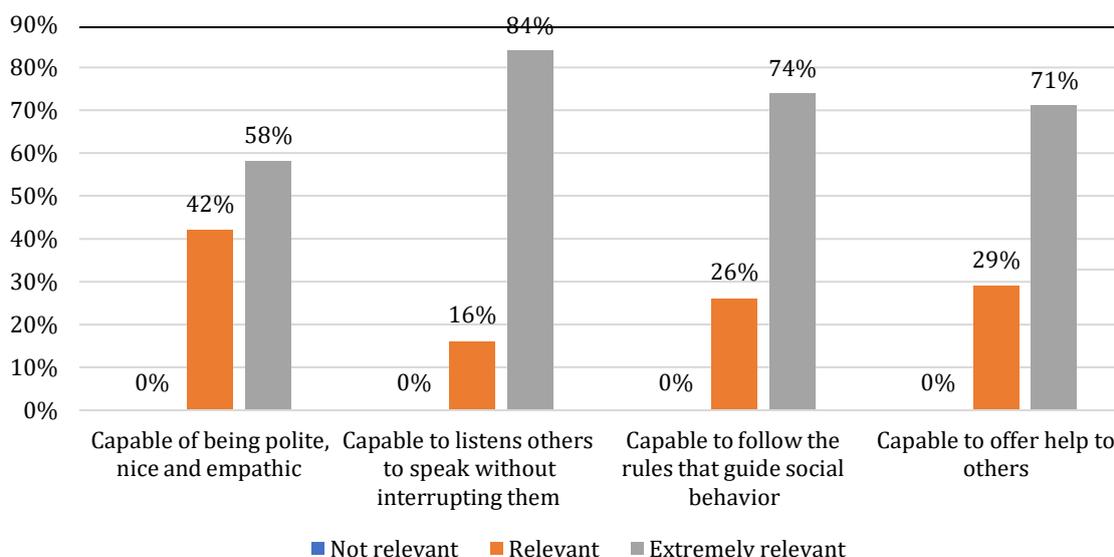
Critical Thinking



Social skills

All the aspects included in the social skills section have been considered relevant or extremely relevant. “To be capable to listen to others speaks without interrupting them” has been rated the most extremely relevant by 84% of the participants, followed by “to be capable to follow the rules that guide social behaviour”, rated as extremely relevant by the 74% of the participants.

Social Skills



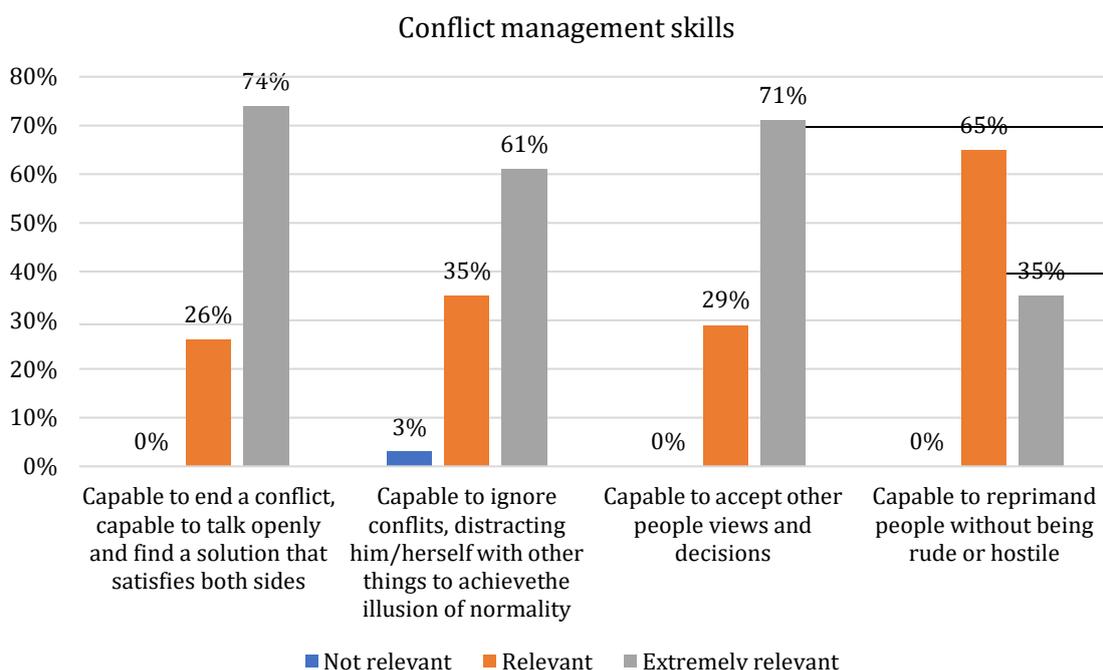
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Conflict management skills

All the aspects included in the conflict management skills section have been considered relevant or extremely relevant.

“To end a conflict and being capable to talk openly and find a solution that satisfies both sides” has been rated extremely relevant by 74% of the participants followed by “to be capable to accept other people views and decisions”, which has been rated extremely relevant by 71% of the participants.



2. Prison teachers and trainers’ needs assessment

The Coding-OUT teachers’ questionnaire was applied to 36 specialists from different organisations and countries.

2.1. Summary of results:

Country

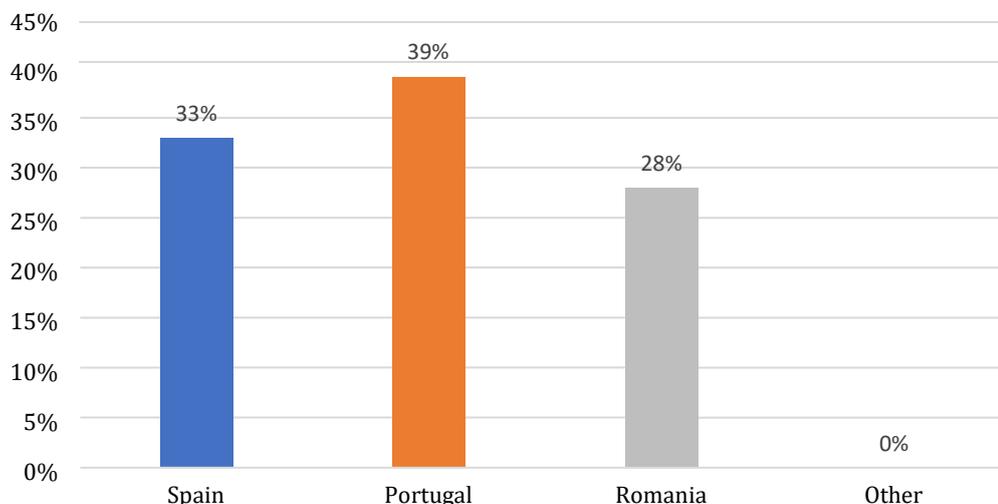
With the cooperation of the whole consortium, the questionnaire was distributed in different countries and companies.

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Total number of participants: 36 organisations

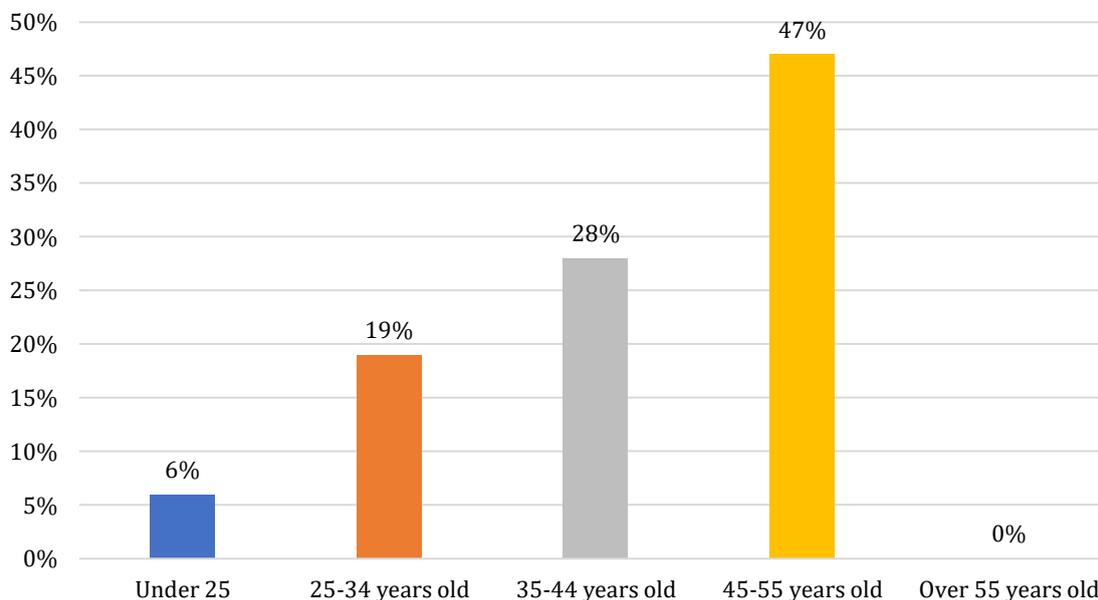
Participants' Country



Age Range

47% of participants are in the range of 45-55 years old, followed by the age range of 35-44 years, with 28% of the participants.

Participants' age



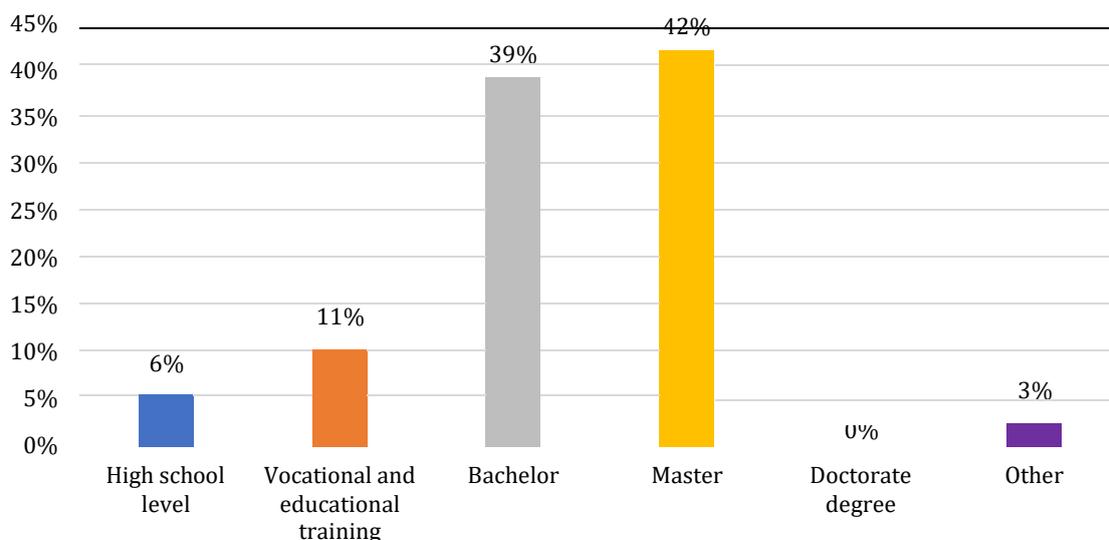
Degree/ level of education

42% of participants indicated that the highest level of education is the master.

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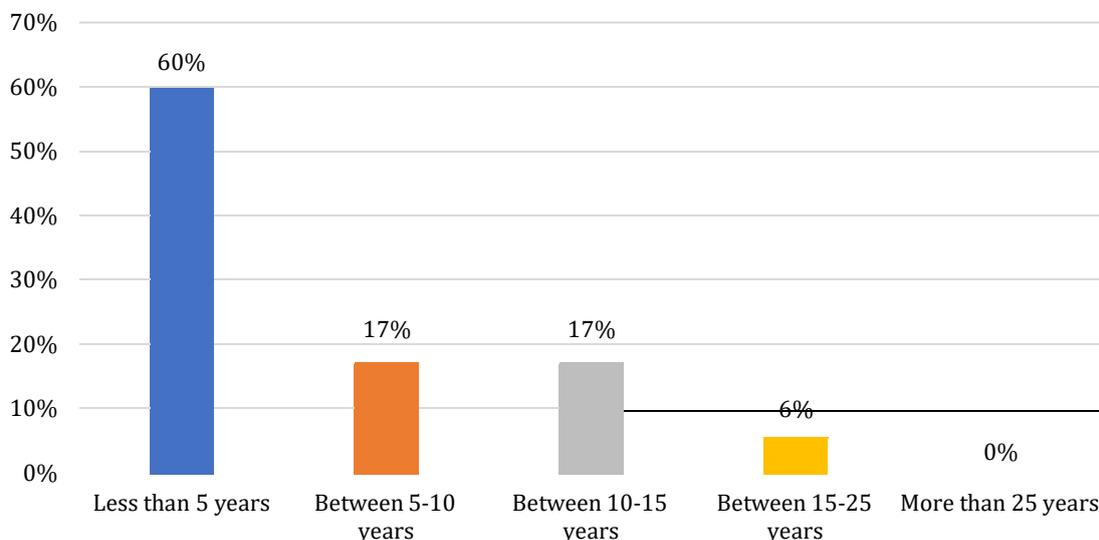
Level of Education



Other: Psychology Degree

Experience as an ICT teacher/trainer in prison settings

Years of experience as teacher/trainer in prison settings



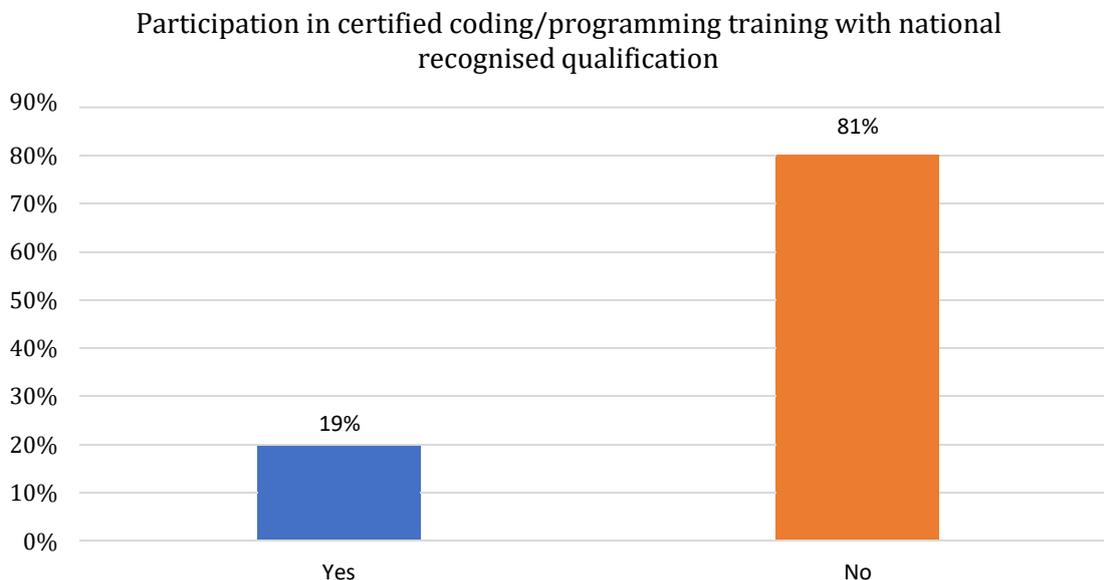
60% of participants have been working as an ICT teacher/trainer in prison less than 5 years. Only 6% of the participants have been working between 15 and 25 years as teacher in prison settings.

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Certification in coding/programming training

Regarding the certification in coding/programming, 81% of participants indicated that they do not have additional certification.



For the 19% of participants that indicated that have participated in a certification training the type of training/certification are the following ones:

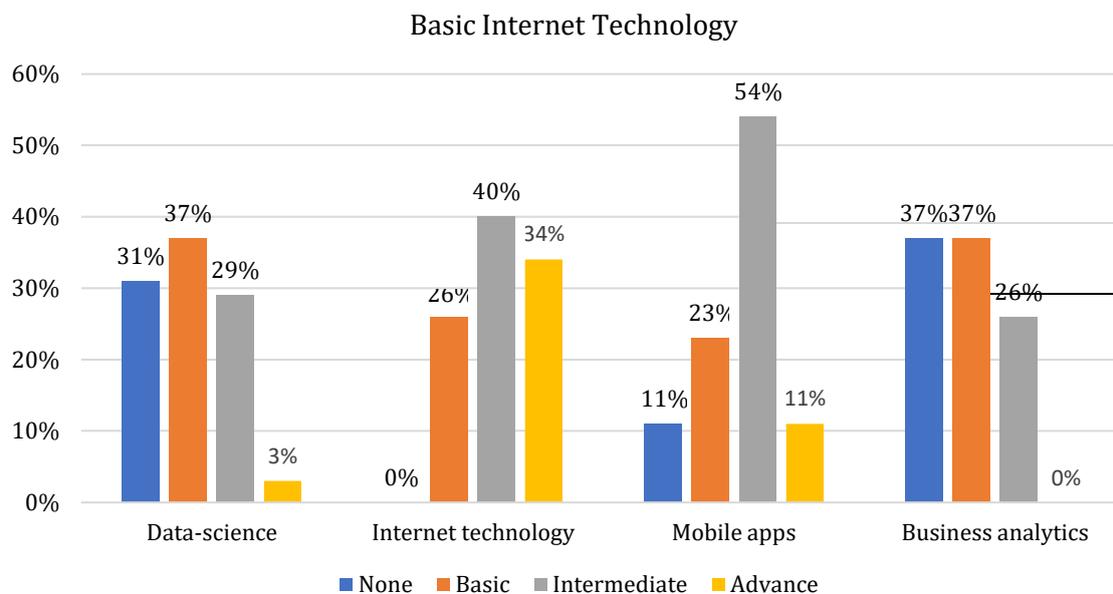
If yes, please specify which type of training (module, specialised course, etc.)

1. Certificate of Professionalism
2. Microsoft Courses
3. Microsoft
4. Prograna Inforjovem - Computers' Trainer Training
5. Bachelor degree in information Management and Computer Science
6. Computer Science Bachelor degree
7. Certificate training in Java, Flash, and programmable automata

Knowledge requirements

Basic internet technology

Intermediate knowledge on mobile apps was the highest rated area with 54% of the participants, followed by intermediate knowledge on internet technology, which was rated with 40%.



Apart from the indicated subjects, participants also indicated knowledge in the following areas:

Other, please identify
7/35

1. Computer networks
2. Microsoft Office
3. Microsoft Office multimedia software and online apps
4. CMS - Advanced; Access - Advanced, Video and image edition
5. Programming
6. Cisco Packet Tracer, GNS, VisualG, Wireshark
7. Operating systems, productivity software, simulators - intermediate level.

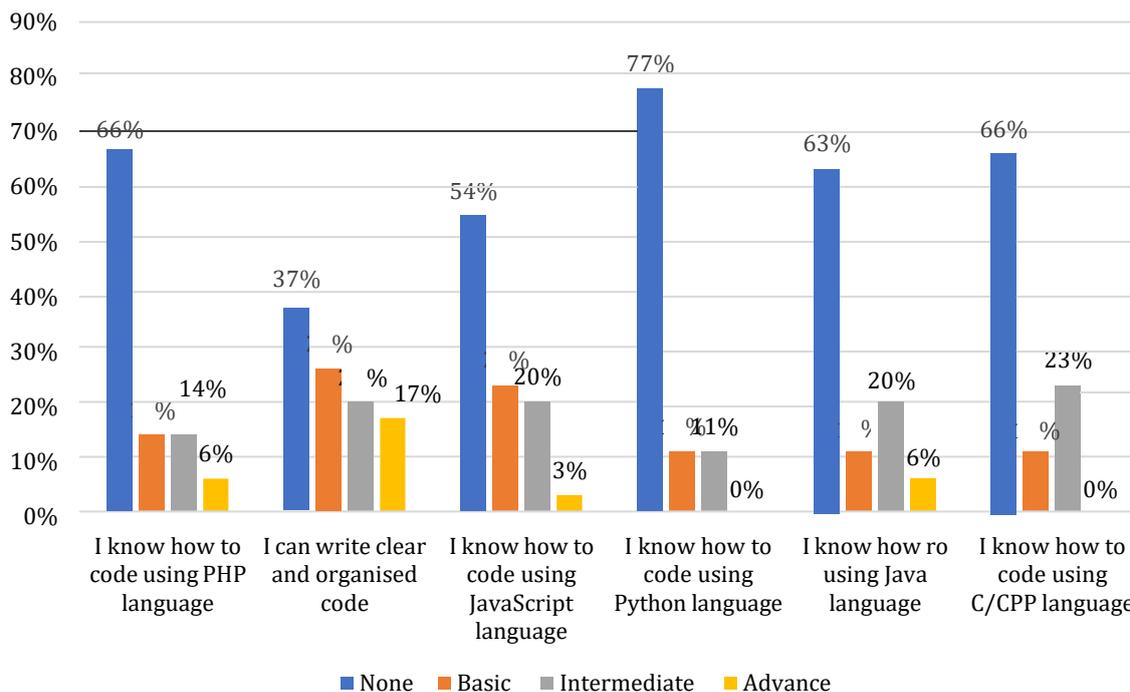


Writing code/Coding Language

Participants mainly indicated that they do not have knowledge on how to write code in different languages. Only 17% of participants indicated that they have advance knowledge in writing clear and organised code.

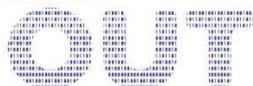
Basic knowledge on JavaScript with 23% of participants, and intermediate knowledge on C/CPP with 23%, were the languages in which the trainers have more knowledge.

Writing code/Coding language

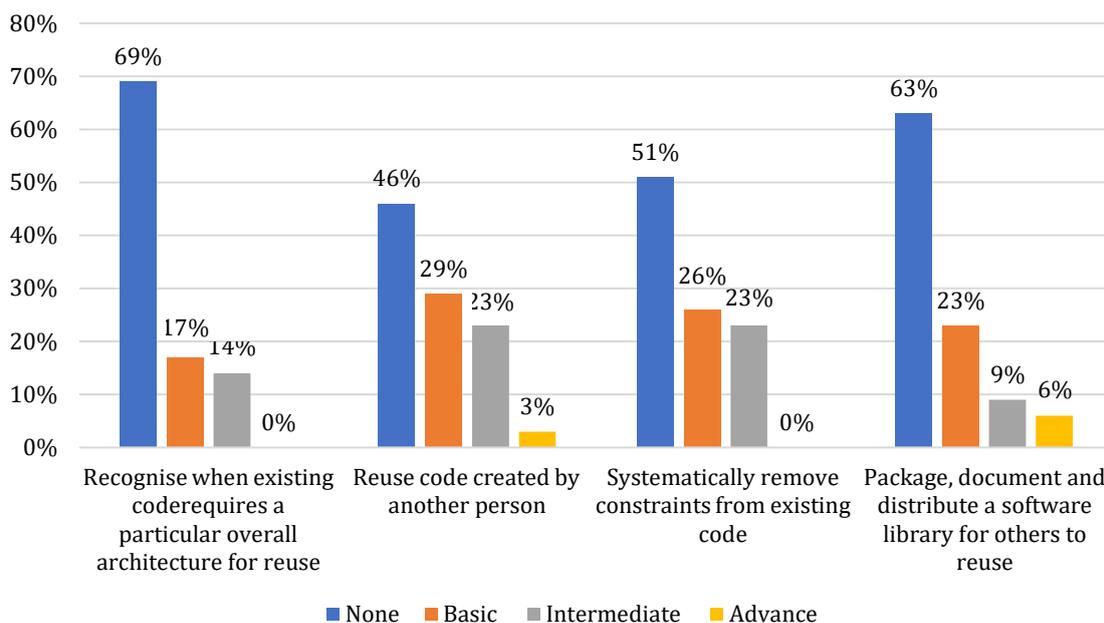


Reuse code

A high number of participants indicated that they will not be able to reuse code. Some of them have only basic knowledge on this. 23% of the participants indicated that they can reuse code created by another person (intermediated knowledge: 23%) and systematically remove constraints from existing code (intermediated knowledge: 23%).

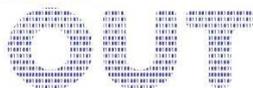


Reuse code

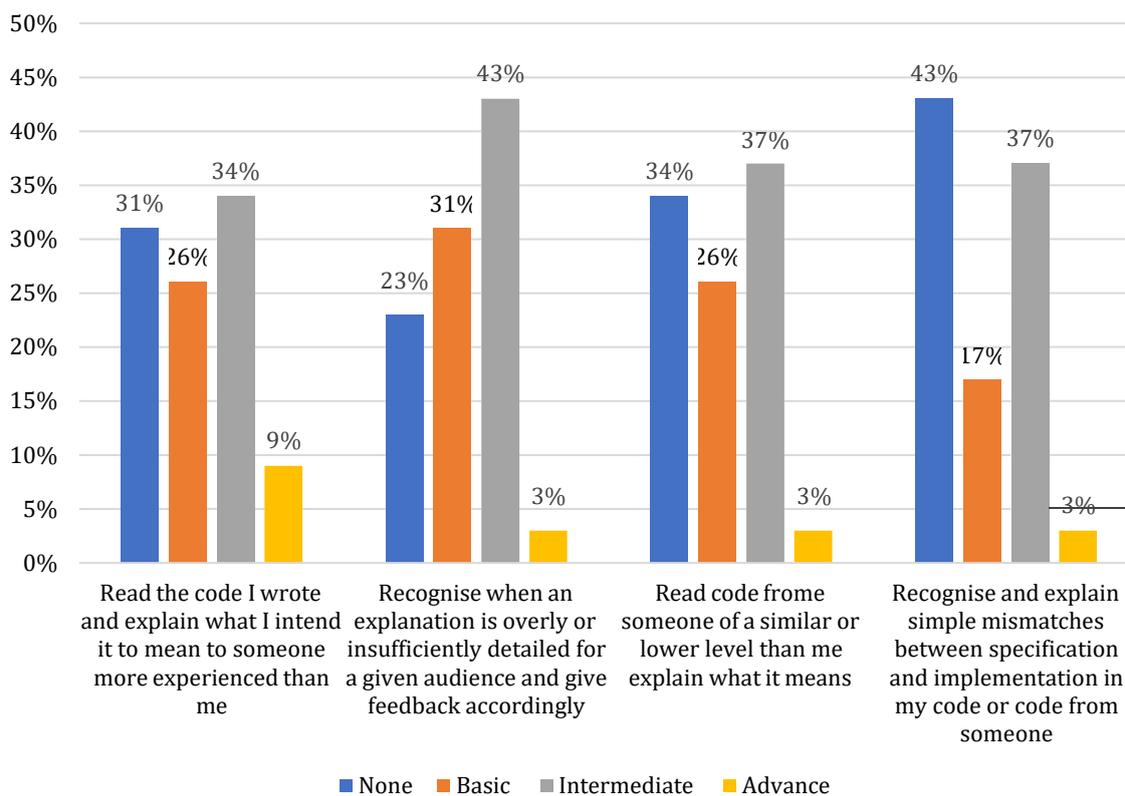


Explaining / Discussing code

43% of participants have intermediate knowledge on recognise when an explanation of overly or insufficiently detailed. In many cases, the participants indicated that they do not know explaining /discussing code.

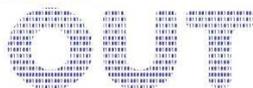


Explaining/Discussing code

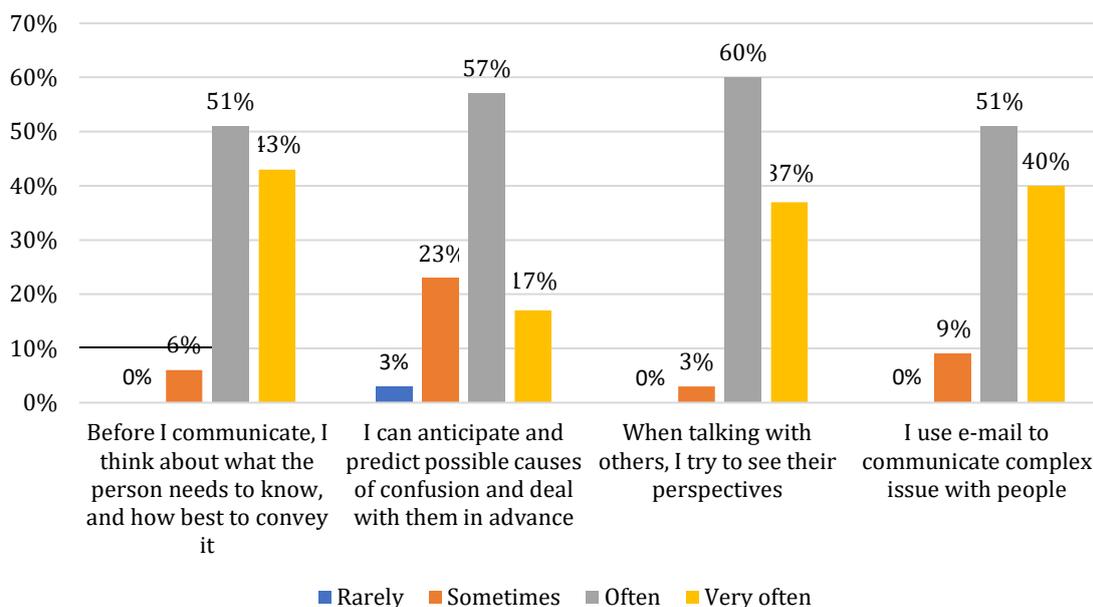


Communication skills

Participants mainly indicated that often or very often they can manage aspects related to communication.



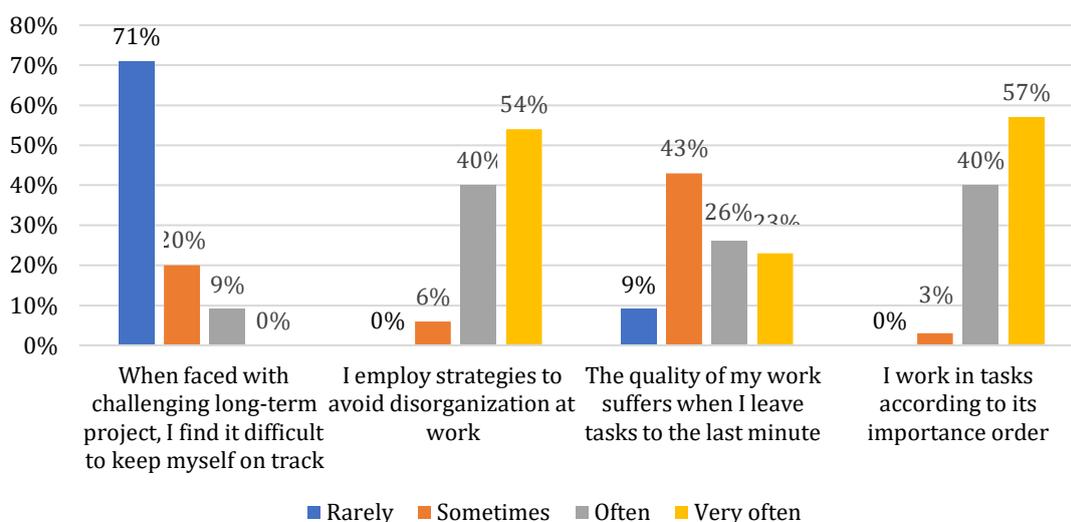
Communication skills



Organisational skills

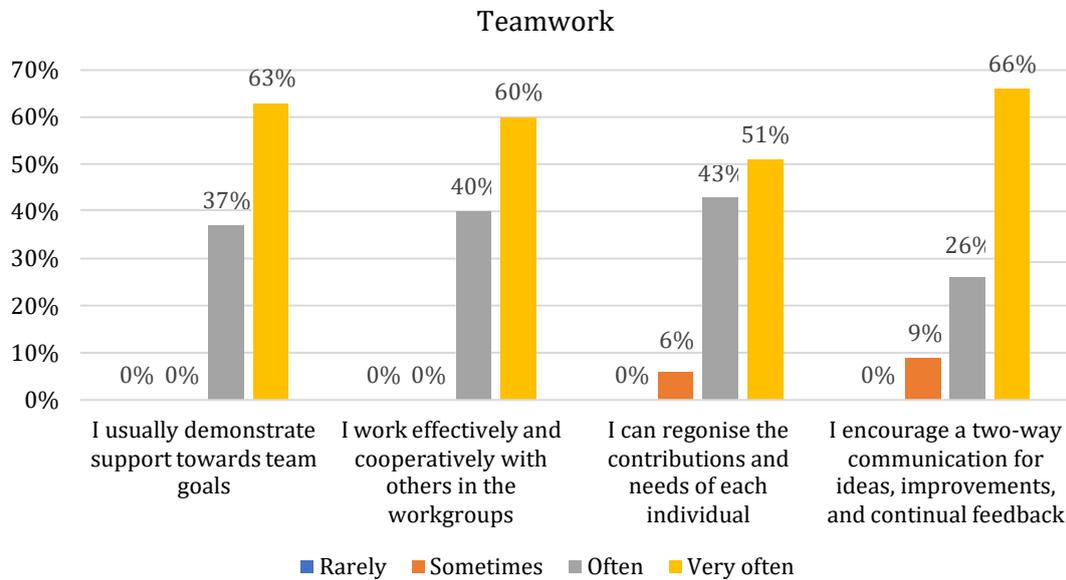
Most participants considered that they “employ strategies to avoid disorganization at work” and “work in tasks according to its importance order” often or very often. Most of them rarely find difficult to keep themselves on track when they faced challenging projects. A considerable part of them affirmed that sometimes, the quality work suffers when the task is left for the last minute.

Organisational skills



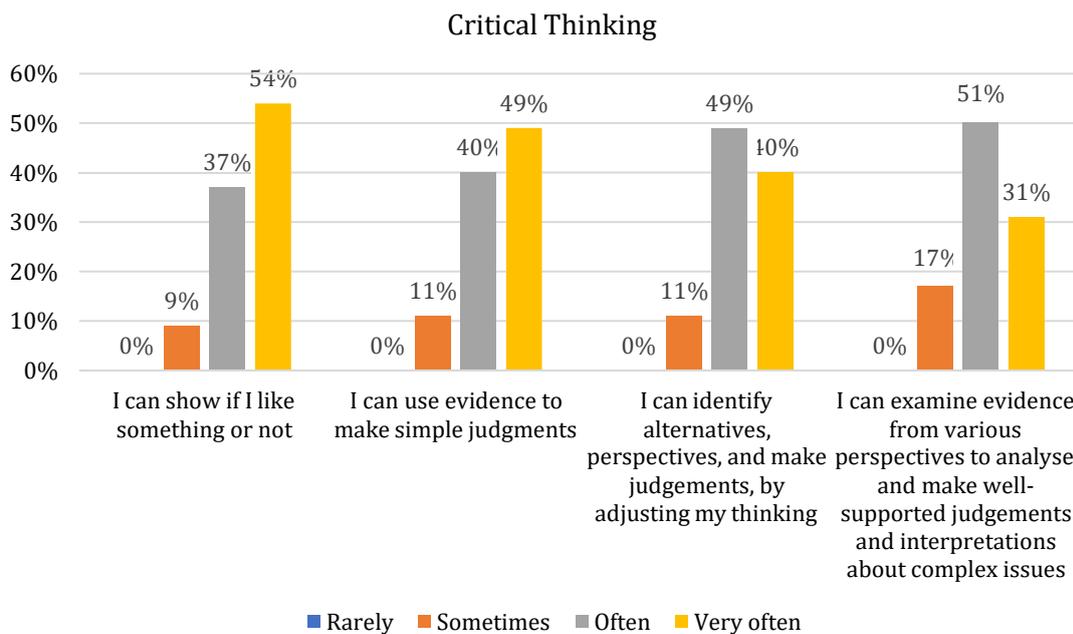
Teamwork

Participants mainly indicated that often or very often they can manage aspects related to teamwork.



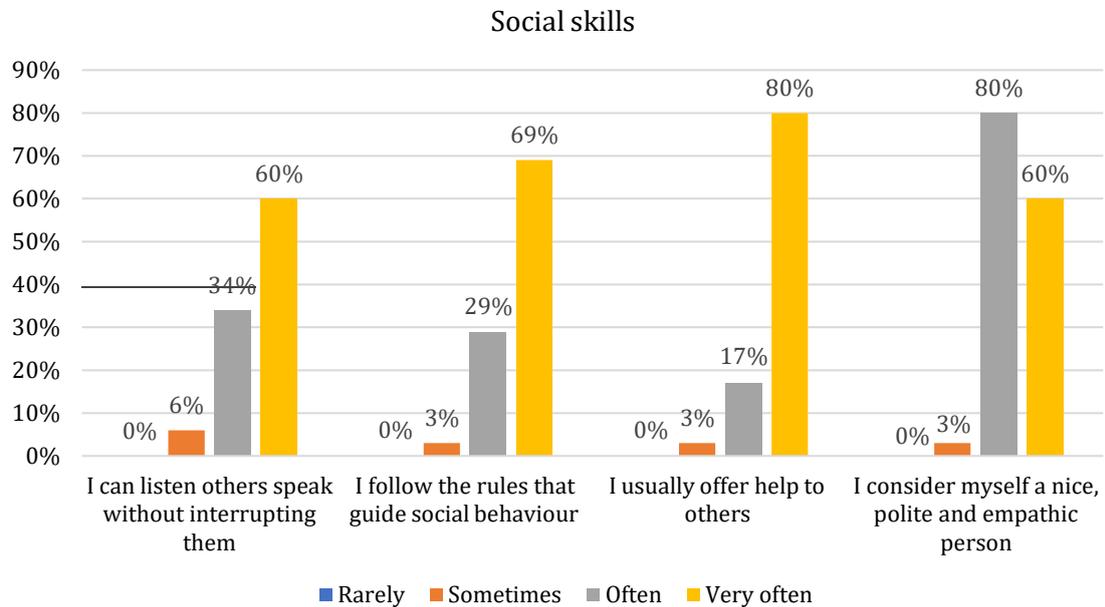
Critical thinking

Participants mainly indicated that often or very often they can have skills related to critical thinking.



Social skills

Participants mainly indicated that often or very often they applied their social skills.



Conflict management skills

Almost half of the participants considered that sometimes they “tend to ignore conflicts and prefer to distract themselves with other things”. Most of them consider that sometimes or often they “can force people to go out their way for them without being rude or hostile” and “to end a conflict, they prefer to talk openly and find a solution that satisfies both sides”. Most applicants referred that often they “try to find a solution that satisfies everyone involved, even if this means giving up some of their interests”.



Conflict management skills



Conclusions

Teaching computer programming is one of the most difficult parts of any computer course. It is challenging not only training students on how to use pre-made programmes but also teaching how to create new programmes for other people to use. The programming education has a human-centred component, where the first step encompasses trying to discover the motivations, values, and needs of each age group before designing tools and interventions for them. Coding and programming play a crucial role in the education agenda given their importance in the digital society that we live in. However, there is a lack of IT-skilled labour force in Europe. Hence, Coding-OUT project will not only narrow the gap regarding the lack of a skilled workforce but will also increase the chances of inmates' successfully reintegration and job retainment after release. To achieve such goals, there is a need to map the relevant labour competencies that employers look for when recruiting and adjusting programmes/initiatives for inmates accordingly.

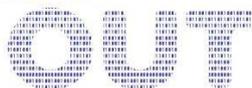
Based on the results reached through our assessment (reported in chapter two), we were able to adapt the training program curricula to the existent needs. On one hand, we could understand the requirements of employers, and thus, we increase our knowledge regarding the skills that should be developed and improved in the inmates. On the other hand, we evaluate the level of expertise of trainers and teachers, and therefore, we acknowledged which areas should be the target of training in our programme.

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Our results indicated that employers tend to consider basic internet skills and writing, explaining and reuse code as extremely relevant for those who work in this field. Moreover, they consider very important to have skills in specific work tools (i.e., Microsoft, Windows, and Web browsers). Despite the technical skills, employers also indicated to value other skills (i.e., communication and organisation skills, competence in teamwork, critical thinking, soft skills, and conflict management ability). Regarding teachers' and trainers' needs, our results shown that most of them did not have certified qualification on coding. In accordance, in general, they presented only a very basic level in coding skill, even if their level of basic internet technologies was mainly intermediate. Regarding non-technical skills, professionals referred that often or very often they applied their social, communicational and organisational skills, as well as the ability in teamwork and conflict management.

In sum, all these findings provide us a conclusion that, in order to increase prisoners' chances to get a job in IT sector, it is crucial to provide them the tools to develop technical code skills. Still, given the importance of teachers' and trainers' role in inmates' learning, we need to train professionals with the necessary knowledge, and considering our results, this is a major concern of our project. By doing so, staff can train inmates on essential coding competencies paving their way to an effective reintegration in society, by contributing to job finding and retainment.



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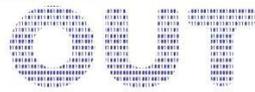
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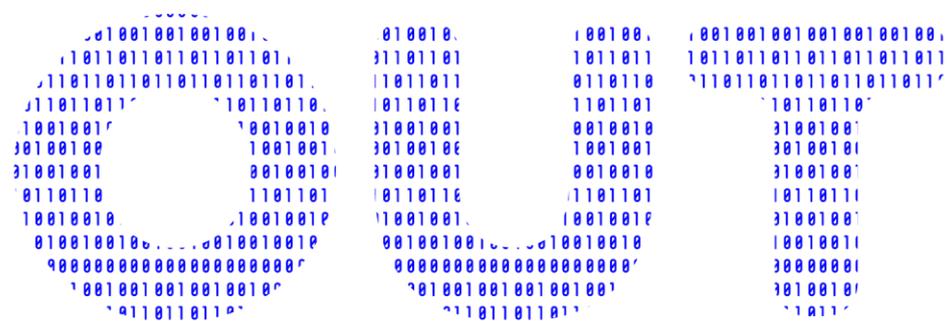
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C O D I N G -



> valuable outside tool for employment

BRIEF STATE OF THE ART ANALYSIS AND NEEDS ASSESSMENT

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