NATIONAL REPORT - BE

CODESKILLS4ROBOTICS: Promoting Coding & STEM Skills through Robotics: Supporting Primary Schools to Develop Inclusive Digital Strategies for All

IO1: Building the CODESKILLS4ROBOTICS Competence Framework: From Theory to Practice

Partner: Lifelong Learning Platform (LLLP), Belgium

Grant Agreement No: 2018-1-EL01-KA201-047823

Website: http://codeskills4robotics.eu/

January 2019

Co-funded by the Erasmus+ Programme of the European Union

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ IKY

CODESKILLS 4ROBOTICS

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein." "Funded by the Erasmus+ Programme of the European Union"

Executive Summary

The present report will offer an overview of the state of digital education in Belgium (and in its three language Communities, more specifically) with a focus on ICT and robotics. After presenting the main policy objectives outlined by each Community, more detail will be provided about the general structure of local primary school curricula and specific local policy initiatives connected to digitalization. The EU perspective will also be analyzed, going into detail about the most relevant recent policy documents and the path envisaged by the institutions for the upcoming years. Finally, the report will contextualize the CODESKILLS4ROBOTICS project in the national and European perspective and describe its envisioned impact at both levels.

Table of Contents

1. Introduction

Programming and computational thinking skills are becoming ever more important in our society and working life: an increasingly digitalized economy has transformed the labor market and brought digital skills to the forefront of the educational scene. As emphasized by the 2015 New priorities ET 2020, "**knowing how to code is empowering**. It allows to understand the digital world we live in and to shape it. Basic coding skills are essential for accessing the jobs of tomorrow and today". In light of these recommendations, ICT school curricula have been shifting their focus from computer literacy to **digital literacy**, i.e. on teaching students not only how to work a computer, but mostly how a computer works and how to make it work for you. Often selected as an introductory channel to programming, **robotics** effectively initiates students to various STEM disciplines while also promoting transversal employability skills such as problem solving, leadership and creativity.

In the above context, the CODESKILLS4ROBOTICS project pioneers:

- To design, pilot-test and evaluate a **complete tool kit** that will support primary schools in developing their own digital-inclusive strategies for the promotion of coding, robotics and STEM skills;
- To develop an **educational pack** containing all the essential materials, tools and resources for the introduction of coding and robotics to primary schools; the educational pack will be based on a targeted Digital Competence Framework, which will also serve as a basis for the monitoring and assessment of the students' progress;
- To introduce the Open Badges system as a method to validate and award the coding skills acquired by both teachers and students, in conjunction with an online **assessment tool** developed to this purpose; a mobile app meant to support teaching, learning and assessment will also be developed;
- In accordance with the 2018 Digital Education Action Plan for EU, to design a strong **campaign** as part of the EU Code/Robotics Week; CODESKILLS4ROBOTICS Competitions will be organized at the regional, national and EU level, thus promoting transnational cooperation.

The main result of the first intellectual output will be the production of a **Comparative Report** presenting the current practice in partner countries in relation to digital, coding and robotic skills. The Report will take into account EU Recommendations as well as the needs of primary teachers and students that will emerge from a dedicated **survey**. The survey, employing triangular methods, is intended to identify the digital gap between students and teachers and will help in achieving a targeted CODESKILLS4ROBOTICS programme. Based on the needs emerged from the survey, a

Competence Framework will be developed with in-built benchmarks and indicators against which students' digital skills will be monitored and assessed. **Market research** for possible resources/tools/equipment (e.g. robots for coding) will also be conducted.

As far as the **Belgian context** is concerned, CODESKILLS4ROBOTICS will produce useful resources for the development and implementation of strategies to promote coding and robotics in primary schools, and it will contribute to bridging the existing gap between EU- and national level digital education policies, as well as between the policy and organizational level.

2. CODESKILLS4ROBOTICS Project Consortium

The CODESKILLS4ROBOTICS Consortium consists of six (6) Organizations from four (4) European countries (Figure 1):

P1	GR	National Center for Scientific Research "Demokritos"
P2	BE	Lifelong Learning Platform
P3	GR	Regional Directorate of Primary and Secondary School Education of Crete
P4	CY	Emphasys Centre
P5	GR	Hellenic Mediterranean University
P6	SE	Halsingland Education Association

3. EU Policies on Digital Education and Robotics

The issue of digital skills is not new to the European policy agenda and has been discussed in different policy documents since the late 1990s, when computers and the Internet first started to influence the economy, the labor market and society as a whole. From the point of view of education policies, the turn of the century marked a shift from operational to strategic policy objectives, and from technology integration towards fostering innovation and competitiveness through the integration of digital technologies into education.

In the year 2000, EU heads of state and government took a stance on technological change and adopted the so-called Lisbon strategy[1], a European commitment to overcome Europe's relative deficit in growth and productivity, mainly due to a lack of technological capacity and innovation. Within the strategy, significant emphasis was placed on access to ICT infrastructure and broadband Internet coverage, as well as on their better use.

The first major policy document on digital skills came a year later, when the European Commission adopted the e-Learning Action Plan – Designing tomorrow's education[2]. The document stressed the need to develop digital skills and set out a series of specific actions for different target groups; the actions targeted to the education sector included:

- Enabling high-speed Internet access in schools and universities;
- Providing access to educational services and e-learning platforms for teachers, pupils and parents;
- Training teachers in the use of digital technologies;
- Adapting curricula to incorporate new ways of learning ICTs.

Digital education policies up to this point are generally considered as part of a wider "first-generation" policy reform with a primary focus on infrastructure development. Starting from the following year and building on the foundation of the two aforementioned documents, a "second generation" of digital education policies started shifting the focus on complementary policy measures such as teacher training, competence building and content development.

Two main policy documents have shaped the course of "second-generation" policies: the New Skills Agenda for Europe and the Digital Education Action Plan.

The New Skills Agenda is the most important recent EU policy document in the area of skills. It focuses on digital skills as part of a wider commitment to the improvement of

[1] See https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/00100-r1.en0.htm.
[2] See http://www.aic.lv/ace/ace_disk/Bologna/contrib/EU/e-learn_ACPL.pdf.

"the quality and relevance of skills formation" and it recognizes that almost all jobs, as well as participation in society at large, now require some level of digital skills.

As far as primary education is concerned, Council conclusions discussing digital skills argue that promoting creativity, innovation and digital competence through education during the early years can produce significant benefits later on[3]. While digital tools cannot replace essential classroom activities, experiences and materials, they can contribute to improve the quality and effectiveness of education, as well as the motivation, understanding and learning outcomes of pupils. This of course entails important implications for pedagogic approaches, resources and assessment as well as for the initial education and continued professional development of teachers. An increased use of digital tools in teaching and learning is also inevitably connected to concerns over the development of media literacy skills, particularly the issues of safety and responsibility online.

The Conclusions focus on the following areas of action:

- Access to and promotion of age-appropriate, safe and responsible ICT, digital equipment and digital tools in primary education;
- Focus on teachers and school leaders, including on their abilities to use ICT for teaching, on new pedagogical approaches and on the provision of more personalized teaching for a wide range of abilities and disadvantages;
- Cooperation – including e-Twinning and other collaboration at all levels, open source communities and exchange of good practices and effective methods of teaching and learning.

The other central document belonging to the "second generation" of digital education policies is the Digital Education Action Plan adopted by the European Commission in January 2018. The document introduces three priorities, each of them outlining actions that aim to "help EU Member States meet the challenges and opportunities of education in the digital age"[4].

The priorities and actions of relevance to the project are the following:

Priority 1 – Making better use of digital technology for teaching and learning

- Action 1: Connectivity in schools – Supporting the roll-out of higher-capacity broadband in schools

  Low connectivity remains one of the main obstacles to the uptake of digital tools that can trigger innovation in schools, coupled with the schools' frequent lack of technical competences to make credible decisions on digital infrastructure and its strategic development.

[3] See https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0607(01)&rid=2.
[4] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:22:FIN.

In order to tackle the connectivity divide, the Action Plan highlights three action areas:

1. Raising awareness of the benefits for schools, and of the available funding opportunities;
2. Supporting connectivity, e.g. through a voucher scheme focusing on disadvantaged areas and ensuring full implementation of the toolkit for rural areas;
3. Publishing data about progress.

The main policy initiative that could contribute to raising awareness and supporting connectivity in rural areas is the EU network of Broadband Competence Offices.

- Action 2: SELFIE self-reflection tool and mentoring scheme for schools – Supporting the digital capacity of schools.

  While many teachers already apply some level of ICT-based teaching in class, they often lack the ability to use technology in a more advanced manner, apart from gathering information or making a simple presentation. Hence the need for specific ICT modules in teachers' degree curricula: education institutions need to stay focused on updating curricula and expanding the number of subjects related to digital competences and applying a horizontal cross-subject approach.

  The Digital Education Action Plan suggests the SELFIE self-assessment tool as the main policy initiative supporting the digital readiness of general and vocational schools. Based on the Digitally-Competent Educational Organisations (DigCompOrg) conceptual framework[5], SELFIE provides a snapshot of each school's strengths and weaknesses in its use of digital technologies for better learning. Schools can use the main output of this tool (a SELFIE School Report) to create an Action Plan to improve the use of digital technologies for better learning.

Priority 2 – Developing digital competences and skills

- Action 6: EU Code Week in schools – Getting more schools involved in EU Code Week

  Europe will lose its competitiveness if education fails to provide digital competences to Europeans of all ages: the lack of basic digital competences limits citizens' ability to take part in learning activities and to fully participate in a digitally-driven society, while the absence of advanced digital skills creates an evident gap in the labor market.

  The Action Plan acknowledges that Europeans should begin acquiring digital skills at an early age, through both curricular and extracurricular activities. One of the initiatives suggested by the Commission to this regard is participation in the EU

[5] See https://ec.europa.eu/jrc/en/digcomporg/framework.

Code Week[6], a grass-root movement run by volunteers which aims to encourage more people to learn computational thinking, understand how computers work and discover coding.

- Action 8: Training in digital and entrepreneurial skills for girls – Addressing the gender gap in digital and entrepreneurship sectors
  The Digital Education Action Plan recognizes a lack of interest among girls to pursue studies in ICT or STEM; this is true from an early age and this is considered to be due to an extent to gender stereotypes.

  In order to address this concern, the Commission will support measures to further decrease the gender gap in the technology and entrepreneurial sector by promoting digital and entrepreneurial competences among girls as well as mobilize stakeholders to equip girls with digital skills and inspirational models.

As far as the implementation of such policies is concerned, research shows that the use of digital technologies to support teaching and learning enjoys widespread support from national authorities in Europe, and that by 2011 all European countries had formulated national policies for ICT in education, either as standalone policies or as part of a wider national strategy[7].

The strategic emphasis of these policies remains on fostering the students' digital competences, as justified by future economic benefits. Their operational aspects focus mainly on teacher training and on the provision of up-to-date technology and infrastructures for schools. Overall, policy direction and vision was found to be developed largely by national administrations while operational policy decisions are often taken in a decentralized way, allowing freedom for local administrations and schools to experiment with and shape their own policies within some top-down parameters.

However, not all students can benefit from these and other digital education policies: a significant implementation gap between national-level strategic objectives and their local-level operationalization persists. For example, while at strategic policy level teacher training is a priority, in most countries teachers' attendance at ICT training was not compulsory[8].

According to the European Commission, "third-generation" digital education policies should focus on building teaching capacity combined with infrastructure measures, often in the form of mobile device provisions.

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[6] See https://codeweek.eu/.
[7] See https://publications.europa.eu/en/publication-detail/-/publication/8f864668-0211-4a40-bc14-65bf1a97b6a8.
[8] See https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1389115469384&uri=CELEX:52013DC0654.

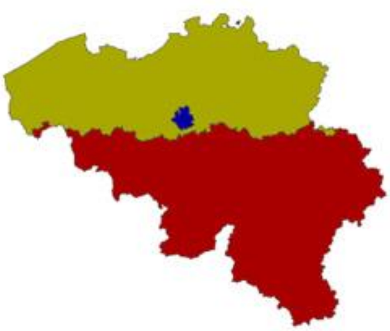
The general consensus underlying recent policy developments is that the provision of digital technologies leads to improved learning outcomes across different disciplines[9]. However, while "technology can amplify great teaching, great technology cannot replace poor teaching"[10]: the impact of the implementation of digital technologies in education depends substantially on contextual factors, the role of teachers being one of the foremost. In order to encourage the integration of digital technologies into teaching practice, teachers require professional development opportunities that focus on the use of technology from a pedagogical perspective. Furthermore, technological programmes need to be implemented as part of a wider pedagogical framework in order to be effective: many teachers still struggle to integrate technology and meet curriculum demands at the same time, indicating a need for a curriculum design that is more conducive to the use of digital technologies.

[9] McEwan, P. J. (2015). *Improving Learning in Primary Schools of Developing Countries: A Meta-Analysis of Randomized Experiments*. Review of Educational Research, 85(3), 353-394; mentioned in Digital Education Policies in Europe and Beyond – Key Design Principles for More Effective Policies (European Commission, Joint Research Centre, 2017), p.14, retrieved from: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digital-education-policies-europe-and-beyond-key-design-principles-more-effective-policies.

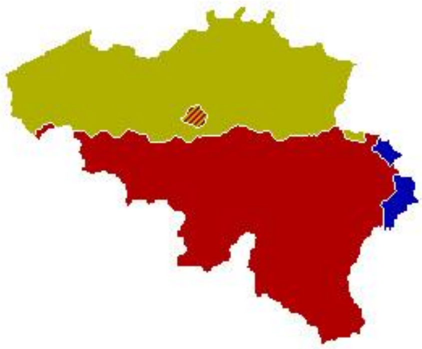
[10] OECD report *Students, Computers and Learning – Making the Connection* (2015); retrieved from http://www.oecd.org/publications/students-computers-and-learning-9789264239555-en.htm.

4. Coding, Robotics and STEM Skills in Primary Schools

Belgium is a federal state composed of **three Regions** (Flemish Region, Walloon Region and Brussels Region) and **three** language-based **Communities** (Flemish Community, French-speaking Community/Federation Wallonia-Brussels, German-speaking Community).



Map of the Regions
Brussels-Capital region (in **blue**)
Walloon region (in **red**)
Flemish region (in **green**)



Map of the communities
Deutch-speaking community (in **green**)
French-sepaking community (in **red**)
Brussels-Capital region (where both communities have competences, streaked in **green** and **red**)
German-speaking community (in **blue**)

Due to its naturally close connection to languages, the education sector falls under the competence of the **Communities**. The present report will therefore focus on three perspectives: the Flemish one, the French-speaking one and the German-speaking one.

4.1 Digital Education Policies for Primary School Education in Belgium

Flemish Community

The Flemish Community does not have a specific policy for digital education in primary schools but general guidelines can be derived from the STEM Action Plan 2012-2020[11], a project of the Flemish government covering the policy areas of Education and Training, Work and Social Economy, and Economy, Science and Innovation.

The Action Plan aims at stimulating the growth of careers in the STEM field; it analyses the state of the art, identifies measurable and verifiable objectives and provides a framework for the development of specific digital education initiatives. The Plan calls for a renewal of didactics for STEM: science, engineering and technology are characterized by innovation and this should be visible already at school level.

More specifically, the Action Plan calls for:

[11] See https://onderwijs.vlaanderen.be/nl/stem-actieplan-2012-2020.

- An integrated approach to STEM: the three disciplines are not separate from each other, and as such they should be presented from primary school level onwards;
- Increasing training opportunities in order to grow more confident and better-equipped teachers of STEM subjects;
- Fostering communication and sharing of best practices in STEM education between teachers.

The STEM Action Plan does not focus specifically on primary education, although it remarks that since fourth and fifth grade students should perceive an explicit attention for science and technology; this will raise their interest in the topic and facilitate them in approaching STEM subjects in secondary school.

More specific recommendations for primary schools may be found in the 2012 report "Kiezen voor STEM"[12] ("Choose STEM") commissioned by the VRWI – Flemish Council for Science and Innovation. Among proposed structural reforms to strengthen the potential of STEM education, the report indicates the necessity for a stronger technical offer in primary schools: all pupils should come into contact with technology from the very beginning (not only from grade five or six) and this should happen in equal measure among boys and girls.

The proposal focuses not only on exposing pupils to technology but primarily on actively raising their interest through inquiry-based learning. From a pedagogic point of view, the report suggests to differentiate more clearly the objectives of scientific education; among them, three should be present ever since primary level: developing rational and scientific thinking, developing an insight into scientific phenomena and raising interest in technology and technical activities. Finally, the report mentions the necessity of specific measures aimed at girls and female teachers.

One of the main digital policy initiatives implemented in the Flemish Community is KlasCement, an online platform where teachers and organizations can share educational resources and best practices with other users.

KlasCement uses a user-driven approach combined with an incentive system. The platform is moderated, therefore all user-uploaded content is reviewed against specific admission and quality criteria before being made available to other teachers. Users rely on a points system, which they gain when they successfully upload or rate content and lose with every download. Downloading privileges are revoked when a user's balance falls to zero points, therefore teachers are incentivized to continue producing and sharing new content which feeds into an ever-growing platform. Teachers who upload particularly outstanding resources are awarded a prize and a special mention on the website.

[12] See https://www.vlaanderen.be/nl/publicaties/detail/kiezen-voor-stem.

KlasCement was initiated in 1998 by Hans De Four, a mathematics and informatics teacher in a Dutch school in Belgium. His intent was to allow teachers to share educational resources with each other; the idea was received with enthusiasm and the platform has since then grown at considerable speed, currently gathering over 67 000 registered members and 50 000 contributions (of which 27 000 dedicated to primary education).

Since 2002 KlasCement is funded by the Flemish Ministry of Education. In 2013 KlasCement was incorporated into the Agency for Educational Communication, which later merged with the Department of Education and Training. Currently, KlasCement represents one of the teams of the Division Communication[13].

French- and German-speaking Community

The French-speaking Community, comprising the Walloon Region and the Brussels-Capital Region, implements a comprehensive digital education policy named École Numérique, which is part of a wider Digital Wallonia strategy[14].

The École Numérique strategy pursues the overall objective of providing primary and secondary schools with quality equipment and Internet connection in order to promote the use of digital technology, to facilitate the acquisition of specific digital skills and to support the learning process at all stages.

École Numérique is comprised of five smaller projects, namely:

1. **Call for projects "École Numérique"**: first launched in 2011 by the Walloon government in cooperation with the government of the Fédération Wallonie-Bruxelles and the German-speaking Community, the calls for projects aim at promoting an innovative use of Information and Communication Technology (ICT) in education, from nursery level up to higher education and both in ordinary and special education.
   The initiative has proven greatly successful in its first editions and the Walloon government has confirmed yearly calls for the duration of the 2016-2019 period of the Digital Wallonia strategy. Submissions from previous years have highlighted a great diversity of needs in terms of digital equipment and confirmed the centrality of technical and pedagogic support as keys to success.
   Individual projects thus function as triggers within a wider effort to initiate and establish pedagogic practices which either exploit or educate to the digital world:

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[13] See https://www.klascement.net/info/.

[14] *Digital Wallonia* is the comprehensive digital strategy of the Walloon Region. It establishes the framework for all governmental actions concerning Wallonia's digital transformation and is articulated around five central themes: Digital Sector, Digital Economy, Skills & Jobs, Open Public Services and Smart & Connected Territory.
See https://www.digitalwallonia.be/fr/strategie-numerique.

since 2011, several projects funded under the "École Numérique" call have indeed developed into durable pedagogic practices[15].

2. **WiFi in schools:** within the framework of the Digital Wallonia strategy, the Walloon government plans to equip 200 schools with high-quality WiFi connection, necessary complement to the use of the devices made available to schools (electronic white boards, PCs, tablets etc.) and to the development of an effective digital policy.
   Schools were selected through a public call launched in June 2016; those selected received funding to set up their connection, namely:
   - The Internet connection proper (WAN), set up either via xDSL, cable, fiber etc.;
   - A Local Area Network (LAN) connecting school devices internally (via cable or, more often, through WiFi).
3. **Bring Your Own Device (BYOD):** in the spring of 2018 the Agence du Numérique has set up a working group to test the necessary technical and organisational conditions for the implementation of "BYOD" policies in schools.
   Ten institutes have volunteered for the pilot and will invite students to bring their own devices to school starting from the 2018-2019 academic year. Participating schools will be supported in defining user's guidelines and, if necessary, will be provided additional devices to ensure equality among students.
4. **Cloud services**: starting from the 2018-2019 academic year, the Walloon government has made Cloud services available to schools; this will allow teachers and students to access educational resources both at school and from home.
5. **Baromètre "Education et numérique 2018"**: in order to assess the state of the art of digital education and the needs of the educational community, the Agence du Numérique (in collaboration with the Brussels-Capital Region, the Fédération Wallonie-Bruxelles and the German-speaking Community) has conducted a survey among principals and teachers between the months of May and September 2017. The survey resulted in a comprehensive report[16] describing the state of digital education in the schools of the interested region and also produced policy recommendations.

Besides shared initiatives with the French-speaking Community, the German-speaking Community has decided to focus the school year 2017-2018 on the topic of Science and Technology in order to contrast the decreasing interest in STEM subjects among

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[15] In 2018 the Agence du Numérique conducted a study intended to measure the medium- and long-term impact of 188 "École Numérique" projects launched in 2014. Findings have shown that such projects had a significant impact on the development of digital practices in beneficiary schools, an effect going well beyond the initial scope of the project to include other teachers and users.
See https://www.digitalwallonia.be/fr/publications/ecolenumerique-home.

[16] See https://www.digitalwallonia.be/fr/publications/education2018.

students. Schools were invited to take part in conferences, events and competitions as well as to submit project applications for the promotion of STEM skills; the three best projects would receive financial support for implementation.

4.2 Infrastructure Supporting ICTs and Robotics

Flemish Community

In Flanders, ICT-infrastructure policies are currently limited to telecom services and software provisions. The Flemish government negotiates framework agreements with telecom providers and software resellers in order to provide flat fees for educational institutions[17].

French-speaking Community

As detailed in the previous section, the French-speaking Community has been very active in developing the digital capacity of their school network in recent years. A growing number of schools now have access to high-quality Internet connection, digital educational supports such as electronic white boards, PCs and tablets as well as Cloud services to store and share educational resources.

All schools also have access to the calls for projects "École Numérique", among which programmable robots have made increasing apparitions. Robots allow pupils to familiarize themselves with the programming languages which underlie the technology the experience in their everyday lives, and facilitates the learning process in science and mathematics. By May 2018, 800 robot-related projects had already been approved and funded by the Digital Wallonia strategy, each of them comprising the robots themselves, support in the development of the teaching programme as well as specific teachers training.

The use of programmable robots in primary schools, however, is still far from wide-spread: according to the report "Education et Numérique" mentioned above, only 30% of teachers in the French- and German-speaking Communities use digital devices in class, and the number of robots available is as low as 3.6 per 10 000 pupils, on average[18].

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[17] See http://www.eun.org/documents/411753/839549/Country+Report+Flanders+2017.pdf/5dd41869-0b28-4ef5-89c9-c3d4518d5cc4.

[18] See https://content.digitalwallonia.be/post/20180322084610/Barome%CC%80tre-2018-Digital-Wallonia-Education-Nume%CC%81rique-Infographie.pdf.

4.3 Integration of Coding, Robotics and STEM Skills in the School Curriculum

Flemish Community

In Flanders, primary school curricula are generally structured as follows:

Table I: Flemish primary school curricula structure	
Subject-related final objectives	Physical education, Dutch, French, Science and Technology, Humans and Society, Expressive arts, Mathematics.
Cross-curricular final objectives	ICT, Learning to learn, Social skills.

ICT is considered to provide opportunities within all subjects and fields of study at primary school level. Therefore, ICT is not taught as a separate subject but rather integrated in the school curriculum as one of three **cross-curricular final objectives**[19].

More specifically, cross-curricular final objectives and developmental aims for ICT include[20]:

1. Pupils have a positive attitude towards ICT and are willing to use ICT in support of their learning;
2. Pupils use ICT in a safe, sensible and appropriate way;
3. Pupils are able to practice independently in an ICT-supported learning environment;
4. Pupils are able to learn independently in an ICT-supported learning environment;
5. Pupils are able to use ICT to express their own ideas in a creative way;
6. Pupils can retrieve, process and save digital information that is appropriate for them, by means of ICT;
7. Pupils are able to use ICT in presenting information to others;
8. Pupils are able to use ICT to communicate in a safe, sensible and appropriate way.

French-speaking Community

Primary school curricula in the French-speaking Community are broadly regulated by the so-called Décret "Missions" adopted by the Parliament of the French-speaking Community in July 1997. The Décret establishes a series of Core Skills (Socles des

[19] The Flemish Ministry's Agency for Quality in Education and Training set a distinction between "final objectives" (*eindtermen*) and "developmental objectives" (*ontwikkelingsdoelen*). The first are minimum objectives linked to knowledge, insight, skills and attitude, while the latter are minimum objectives considered desirable for special education by the educational government.
[20] The following objectives apply to normal primary education and special primary education of types 1, 2, 7, 8 (i.e. pupils with a mild, moderate or serious mental disability, deaf or hard of hearing and pupils with serious learning difficulties).

compétences)[21] i.e. basic competences to be acquired at each level of education, in all networks, schools and classes.

The school curriculum in primary schools is expected to contain the following subjects: French, Math, Science, History and geography, Modern languages, Physical education, Education to technology, Artistic education and Philosophical classes.

Education to technology is understood in a relatively broad sense as a course based on the idea of technology as "a discipline that contributes to the overall training of young people just as much as general educations courses do"[22]. More specifically, technology education is expected to contribute to the development of different ways of thinking and to favor the acquisition of a technological problem-solving approach with a technical object and/or technical concept as a support.

This approach is applied to different fields; among them, two are those of interest to the project:

- **Electronics**: Technological control: technology using electrical and electronic systems. These can be simple electrical circuits, complex integrated electronic circuits or robotics;
- **Information and communication technology**: Systems that enable the collection, structuring, manipulation, retrieval and communication of information in various forms.

German-speaking Community

Primary school curricula in the German-speaking Community are regulated by the Decree establishing core competences and Framework plans in education (Dekret zur Festlegung von Kernkompetenzen und Rahmenplänen im Unterrichtswesen) of June 16, 2008[23]. According to the Decree, the main objectives for primary school (and for the first stage of secondary school) were defined within the following subjects and fields:

- English as language of instruction;
- French as first foreign language;
- Mathematics;

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[21] Officially defined as "a reference framework offering a structured presentation of the basic skills to be exercised up to the end of the first eight years of compulsory education and of those to be mastered at the end of each stage of compulsory education because considered necessary for social integration and further education".
See http://www.enseignement.be/index.php?page=23827&do_id=401.

[22] See http://www.enseignement.be/index.php?page=24737 (*Les Socles des compétences – éducation par la technologie*, p. 62).

[23] See http://documents.dgparlament.be/dltdownload/ezgQLGtDid5oap81AxA_wIMG4KmkbS40535rOVCnS_Df.pdf.

- History/Geography;
- Science/Technology;
- Music/Art;
- Sports.

Multidisciplinary skills, including e.g. social and personal skills, are also included in the framework.

The competences expected to be acquired are only described in general terms and make no specific reference to the topics of interest of the project. Generally speaking, technology courses are intended for students to develop skills that will enable them to solve technical problems of everyday life, as well as to develop their creativity and crafting skills and to raise their interest in technology-oriented occupations[24].

The macro-competences that pupils are expected to acquire include:

- Communicating in a technological way;
- Assessing the effects of technological activities in a technological way;
- Building and constructing;
- Understanding and solving technical problems;
- Recognizing production processes;
- Understanding technology;
- Discovering the causes and effects of technological development.

4.4 Existing Gaps

Based on the results presented above, the following potential gaps can be identified:

- (Decreasing) lack in infrastructures: despite significant efforts at Community level, the persisting lack of adequate ICT infrastructure might hinder the efforts to support the implementation of digital education initiatives in Belgian primary schools.
- Narrow perspective: the development of ICT infrastructures in schools are not (yet) supported by dedicated training courses for teachers. This might result in the development of a gap between the technical/infrastructural and pedagogic capacity of primary schools in Belgium.
- Lack of a cohesive national strategy for digital education: while the French-speaking community seems to be increasingly committed to fostering digital education through the development of policy initiatives and ICT infrastructures, the

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[24] See http://www.ostbelgienbildung.be/PortalData/21/Resources/downloads/schule_ausbildung/schulische_ausbildung/rahmenplaene_neu/RP_Naturwissenschaften_Technik_PRIM_SEK_1_Stufe.pdf.

other two Communities appear to be slightly less advanced. This might lead to the creation of a digital divide between school students belonging to the three distinct Communities.

4.5 Other Relevant European or National Projects

- STEM Through Robotics (2018-1-FI01-KA229-047201) – FI, SI, PL, TR
- Numeracy and Literacy through Coding and Robotics (2018-1-MT01-KA229-038504) – MT, SI, IT, PT
- Developing STEM Competences with Robotics (2018-1-NO01-KA202-038813) – NO, EE, CY, HR, ES, EL, BG
- EARLY: Education Advancements through Robotics Labs for Youth (2018-1-IS01-KA201-038812) – IS, EE, PL, IT, FI
- Through Robotics and Collaboration to the Successful Citizens of the 21st Century (2017-1-EE01-KA219-034903) – EE, EL, ES
- CODEBOTTING – Learning through Coding and Robotics (2017-1-EE01-KA219-034887) – EE, ES, IS, NO, FI
- Robotics and STEM Education for Children and Primary Schools (2017-1-ES01-KA201-038204) – ES, SE, IT, CY
- ROBOTICS4STEM (2016-1-UK01-KA219-024340) – UK, ES, IT, TR, BE
- Robotics for Primary Schools in the 21st Century (2015-1-UK01-KA201-013527) – UK, MT, DK, ES, LT
- Robotics for Schools (2014-1-EE01-KA200-000485) – EE, FI, UK, SE

5. Results and Conclusion

The general picture emerging from the present report lends itself to different considerations on the state of digital education in Belgium.

Firstly, Belgium remains an unsurprisingly complicated country from the administrative point of view: the territorial division into Regions and the linguistic/cultural distinction between language Communities (each with different competences) makes it difficult to draw general, country-wide conclusions. It can be argued, however, that Belgium follows along a European trend of increasing interest and commitment to the implementation of digital education policies in primary schools. Each Community has recently invested in wide-ranging policy initiatives concerning digital technology and education in schools, with a particularly well-structured digital strategy in the French- and German-speaking Communities.

The digital education policies currently in place in Belgium, however, still demonstrate a distinct emphasis on infrastructural development (as typical of "first-generation" policies), while no significant advancements have been made in the field of teacher training and capacity building. CODESKILLS4ROBOTICS will not have a direct impact on teacher's degree curricula, but it will contribute, at least from a short-term perspective, to support teachers in introducing their pupils to coding, robotics and STEM disciplines.

CODESKILLS4ROBOTICS intends to pay particular attention to girls as part of its target group, which aligns with the concerns over the gender gap in the STEM field expressed by both national- and EU-level authorities. This will hopefully contribute, in the long term, to raise and sustain the interest of young women in the scientific field.

The main challenge facing Belgium and most other European countries is currently moving from "first-" to "second-" and "third-generation" policies, i.e. from infrastructural development (short term) to teacher training and capacity building (long term). While CODESKILLS4ROBOTICS will not be pilot-tested in Belgium, the partnership hopes that it will contribute to bridging the gap between the two, as well as between the priorities outline by the European Union and their implementation and realization at national level.

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