

The integration of Digital Competences into the Primary Education Curriculum

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Abstract. *The imminent digitalisation of education in Romania is described and announced by the "Strategy on the digitalisation of education in Romania" (document in public consultation). This will bring a number of updates to primary education but, to analyze this transition, this paper sets out why the focus on digital education is needed, what will be left behind by the future update in the primary education curriculum and the prospects for updating it. The analysis of the actual curriculum indicates that only two of the competences specific to all subjects in primary education tangentially support the development of digital competence. This analysis was carried out under the common terminology used in definitions of digital competence extracted from European education policies as well as common reference tools at European and national level. For a more accurate correlation of the curricular projection with the targeted key competence were analyzed, based on the same terminology, even the learning activities suggested by school curricula, finding a low proportion of integration of digital competences in teaching. Therefore, tomorrow's school projections viewed through the "Strategy on the digitalisation of education in Romania", in relation to the data of this paper, are welcome.*

Keywords: *digital education, digital competence, curricular digitalisation, primary education.*

Introduction

The whole world is in a continuous change and this includes: environment, climate, technologies, human knowledge, learning etc. In the case of digital technologies, because they are at the forefront of technologies, changes are the most visible, the term update (updates) being part of the vocabulary of the digital age generations. These updates involve reconfigurations in the education process, which is also preparing for an update, the Ministry of Education and Research launching in public debate, at the end of 2020, the *Strategy on digitalisation of education in Romania 2021-2027*. This comes as a pressing need of synchronization with reality, of ensuring access to information adapted to the realization of education through a digitally accessible curricular offer¹. The digitalisation of the curriculum implicitly responds to the need of developing students' digital competences, the *Strategy on the digitalisation of education in Romania* including even the primary education. To highlight the

¹ L. Nițulescu, C. Ispas, „Curriculum școlar: Managementul conținuturilor în spațiul virtual. Situații și experiențe de învățare online”, în Ion Albulescu, Horațiu Catalano (eds.), *e-Didactica. Procesul de instruire în mediul online*, București, Didactica Publishing House, 2021, p. 63-90.

step forward, this material captures what will be left behind, at this level, by the next curricular update, which has already been initiated.

Definitions of digital competence

The concept of digital competence is explained in the *EU Council Recommendation on key competences* and outlined in the development profile of graduates, by educational cycles, found in the national education policy established by the *National Curriculum Reference Framework (Cadrul de Referință al Curriculumului Național)*, recently approved at the ministry level.

Thus, the EU Council, through the Annex *Key competences for lifelong learning. A European reference framework* explains the term digital competence as the attribute that an individual must possess, through which to "understand the general principles, mechanisms and logic underlying evolving digital technologies and know the basic function and use of different devices, software and networks"², to understand the significant contribution that digital technologies bring to their personal and professional lives, without neglecting the limitations and risks of these products/ services and to know the ethical principles and the consequences of deviating from them in the use of digital technologies.

The Digital Competence Framework for Citizens (DigComp) delves into the concept of digital competence and highlights what makes an individual digitally competent. Thus, the latest version of this European reference framework, DigComp 2.1 of 2017, according to the authors Carretero, Vuorikari & Punie, presents digital competence structured on 5 areas of competence that develop 21 different specific digital competences, so³:

- Information and data literacy: 1.1 Browsing, searching, filtering data, information and digital content; 1.2 Evaluating data, information and digital content; 1.3 Managing data, information and digital content;
- Communication and collaboration: 2.1 Interacting through digital technologies; 2.2 Sharing through digital technologies; 2.3 Engaging in citizenship through digital technologies; 2.4 Collaborating through digital technologies; 2.5 Netiquette; 2.6 Managing digital identity;

² Consiliul UE, *Recomandarea Consiliului Uniunii Europene privind competențele-cheie pentru învățarea pe tot parcursul vieții (2018/C 189/01)*, 2018. [https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=CELEX:32018H0604\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN)

³ S. Carretero, R. Vuorikari, Y. Punie, *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Luxembourg, Publications Office of the European Union, EUR 28558 EN, 2017, doi:10.2760/38842

- Digital content creation: 3.1 Developing digital content; 3.2 Integrating and re-elaborating digital content; 3.3 Copyright and licences; 3.4 Programming;
- Safety: 4.1 Protecting devices; 4.2 Protecting personal data and privacy; 4.3 Protecting health and well-being; 4.4 Protecting the environment;
- Problem solving: 5.1 Solving technical problems; 5.2 Identifying needs and technological responses; 5.3 Creatively using digital technologies; 5.4 Identifying digital competence gaps.

Thus, digital competence is described by using the term "digital content" 5 times, also the term "digital technologies" 5 times and the term "digital identity" once. These involve various forms of data operation, information transfer and the use of computer equipment to manage these processes. Digital competence also refers to the programming of computers, the set of good practices for web security, as well as the finding and diagnosis of problems arising in the use of digital technologies.

Issues related to the creation of digital content and the use of digital technologies can be found in *National Curriculum Reference Framework*, recently approved by the Ministry of Education and Research, in 2020, which through these concepts outlines the profile of the primary education graduate on an elementary level of development of digital competence, expressed as follows⁴:

- manifestation of curiosity for accessing and creating simple digital content that meets specific learning needs;
- solving simple learning tasks using familiar digital devices and applications, which involve simple functions and rules of use;
- use of digital devices in compliance with simple rules aimed at physical and socio-emotional security;
- applying simple rules of communication and interaction in online communities.

At the same time, an elementary level of development of digital competence, in the vision of the specialists of the Institute of Educational Sciences and of the Ministry of National Education, expressed through the curricular policy document *Guidelines for designing and updating the national curriculum*, developed within the project *Relevant curriculum, education*

⁴ Ministerul Educației și Cercetării, *Repere pentru proiectarea și actualizarea curriculumului național. Cadrul de Referință al Curriculumului Național*, Ordinul MEC nr. 5765 din 15 octombrie 2020 privind documentul de politici educaționale, 2020. <https://drive.google.com/file/d/1RS5JxtULhtbat4OezS4-obRDFXoDrooV/view>

„The Integration of Digital Competences into the Primary Education Curriculum”, *Astra Salvensis*, IX (2021), no. 18, p. 7-21.

open to all (Curriculum relevant, educație deschisă pentru toți – CRED), code SMIS 2014+: 118327 and subject for public consultation through the ministry’s website, in fact the extensive basis from which the National Curriculum Reference Framework was started, involves the following knowledge, skills and behaviors⁵:

- appropriate use of simple functions and applications of digital devices in the immediate environment, with guidance, assistance or support from adults;
- compliance with basic rules and daily routine issues regarding the safe use of digital devices, applications and content;
- intuitive and spontaneous expression of emotional states experienced in interaction with digital applications and devices;
- intuitive recognition of the benefits and risks of using digital devices, applications and content on general health and well-being;
- intuitive modeling of personal preferences, motivations and knowledge interests in the use of digital devices, applications and content;
- intuitive and spontaneous identification of original ways to use digital devices, applications and content in video or audio format in solving simple and familiar problems;
- use of simple functions of digital devices and applications to express personal and original emotions, feelings, phenomena, specific life situations, in familiar contexts.

This extended list is a more complex form that describes the interaction with digital devices, applications, and content and was later summarized in *National Curriculum Reference Framework*.

Common terms that describe digital competence

The set of ideas registered above provides a general orientation for the analysis, development or successful approach, for training purposes, of the educational phenomenon in an institutionalized framework. As to the extent to which this competence is found in the national curriculum and whether it is an object of learning, these definitions of digital competence include a number of details that refers to a set of digital technologies involved in facilitating and adapting learning, along with the development of students, to the digital age.

⁵ Ministerul Educației și Cercetării, *Repere pentru proiectarea, actualizarea și evaluarea curriculumului național*, Document de politici educaționale, 2019 https://www.edu.ro/sites/default/files/DPC_31.10.19_consultare.pdf

Starting from these benchmarks, those specific competencies were sought, within all the study disciplines at the level of primary education, which are subordinated and aim, directly, at the development of the digital competence. In this respect, we looked for the vocabulary that describes and represents as accurately as possible the construct of digital competence. Thus, it was proceeded to the centralization of some terms that characterize the targeted competence, as it appears from its presentation in the analyzed documents. The terms, in the form of keywords, taken into account in the analysis of school curriculum and taken from previously studied definitions of digital competence, are: applications (in computer science domain), programs (including programming), devices, technologies (in the sense of new technologies), digital, internet, online, algorithm (computer science), software, informatics, media, computer and ICT.

Reflection of digital competence in the primary school curriculum

The common terms previously identified for the description of digital competence were sought within the competences specific to the whole package of subjects as a compulsory curriculum for primary education. No such direct relationship was found between specific competences and digital competence or the results are insignificant because the competencies provided in the school curriculum do not fully correlate with terms or synonyms for digital devices, applications or content.

From this package of terms, the digital term is the only one that appears twice in the expression of competences specific to primary education, but these are also cases where the digital domain is considered as an exemplary secondary alternative, with the semantics of an optional or secondary aspect, contained/ exemplified in parentheses. However, 28 learning activities were identified, proposed by the school curricula related to each discipline, which satisfy a concordance ratio: specific competencies vs. digital competence, by modeling discipline specific competencies, determining educational influences on digital competence. Thus, the path of learning activities - specific competences - digital competence, is a process of integrating digital competences in teaching. The learning activities are integrated in the education planning on various study disciplines, in order to develop certain specific competencies to be derived from the digital competence, depending on the affinity of the descriptors of the two competences. These learning activities, suggested

by the school curricula and which include the terms previously decanted as specific features of digital competence, are:

Discipline	Specific competence	Learning activities
Communication in Romanian (2nd grade)	1.4. Expressing interest in receiving oral messages in familiar communication contexts 4.2. Write simple messages, respecting the basic conventions	- interactive applications in computer games with appropriate themes, in which instructions are provided verbally - activities that involve using the computer to write short sentences/ texts
Romanian language and literature (3rd grade)	1.4. Manifestation of curiosity about various types of messages in familiar contexts	- watching children's shows (online or TV) on topics of interest for the class of students; - use of recorder, computer etc. to listen different texts; - listening to stories, happenings, using the tape recorder, computer etc.
Romanian language and literature (4th grade)	4.2. Write short functional texts on paper or digital	- correct completion of the recipient's data on an envelope / book as well as in digital format
Communication in a modern language 1 (2nd grade)	3.1. Manifestation of curiosity for decoding simple and short written messages from the immediate universe	- looking for greeting cards and bringing them to school (including digital greeting cards)
Modern language (3rd grade)	3.1. Recognize the meaning of common phrases typical to everyday life	- making simple computer commands (open, close, copy, paste, print etc.)
Modern language (4th grade)	3.1. Identification of details from simple texts that contain common information	- finding information on the internet
	3.2. Identification of important elements for spotting an event on a poster (including a digital poster) or other medium	/

	1.1. Recognize and write numbers in the range 0-31	- recognition of numbers on a computer keyboard or other digital resources
Mathematics and environmental exploration (preparatory class)	2.1. Orientation and movement in space in relation to specified landmarks/ directions, using phrases such as: in, on, above, below, near, in front, behind, up, down, left, right, horizontal, vertical, oblique	- the use of a simple computer program to view some movements in the plan;
	3.1. Description of simple repetitive phenomena/ processes/ structures from the immediate environment, in order to identify regularities	- exploring age-appropriate educational software
Maths (4th grade)	1.1. Explaining some models/ regularities, for creating one's own reasoning	- using the computer to make repetitive models, respecting given conditions
	3.1. Locating objects in space and symbols in various representations	- view plans and maps on the internet (for example, to locate the school in the community, to view the shortest route between two places)
Natural sciences (3rd grade)	2.2. Implement the given plan for conducting an environmental investigation	- collecting data useful for investigation from different sources (books, magazines, internet , movies, trips, simple experiences) for different stages
	2.5. Presentation of the conclusions of the investigative approach based on a given plan	- elaboration of informative materials to illustrate some results from the investigative approach (for example: posters, drawings, presentations with the help of new technologies)
Natural sciences (4th grade)	2.2. Implementation of the own plan proposed for conducting an environmental investigation	- collecting useful data for own investigation from various sources (for example: from books, movies, internet , simple experiences) for different stages
	2.5. Presentation of the conclusions about the own investigation	- promoting the results of the personal investigation with the help of various tools (for example: photos, drawings, posters, collages, leaflets, brochures,

		models, articles in school magazines, presentations with the help of new technologies)
Music and movement (3rd grade)	1.1. Receiving some songs from children's folklore, carols, some accessible works from the cultural heritage, noticing some differences between them	- watching shows, excerpts from concerts (in the auditorium or on the internet), for example, Prokofiev – Petrică and the wolf
Music and movement (4th grade)	1.1. Receiving some songs from children's folklore, carols, some accessible works from the cultural heritage, with noticing some differences of musical nature and body/ stage movement	- watching music and ballet performances (in the performance hall or on the internet)
	3.3. Improvisation of songs, associated with body movements	- creating simple melodic-rhythmic fragments, using software
Visual arts and practical skills (4th grade)	2.2. Making compositions of your choice, capitalizing on the expressive potential of plastic language	- making simple compositions using computer applications
	2.3. Creating unique, personalized and usable products, after performing predominantly manual, creative and playful activities	- making simple compositions using computer applications
Personal development (first grade)	3.2. Highlighting the importance of learning for oneself	- making collages about what the student likes and dislikes about learning at school, at home, on the street, in the park, on vacation, at the theater, at the museum, on TV, on the internet etc.
History (4th grade)	1.2. Location of historical events in space	- observation of digital maps and simulations of armed confrontations, using ICT

1.3. Recognizing people's concern for reporting to time and space	- making a "history of time measurement" based on information selected from printed or online encyclopedias
2.2. Apply simple source analysis procedures to identify various information about the past	- observation of digital maps and simulations of armed confrontations etc., using ICT - making portfolios on historical topics, using the Internet and encyclopedias in electronic format etc. as sources of information

Table 1. Centralization of learning activities in school curricula at the level of primary education, for the qualitative analysis of the influences that contribute to the development of digital competence (according to <http://programe.ise.ro>).⁶

Even if the development of digital competence is not directly aimed, the path to the development of specific competences at the level of primary education is, in fact, a favorable premise for the development of digital competence, being a previous experience that can be integrated to the next level of schooling and for studying the discipline *Informatics and ICT*. The information assimilated up to the 4th grade, if used in the planning of teaching-learning process, favors the triggering of the development of digital competence to pupils, starting with the 5th grade, where the curricular design offers possibilities of expression on this dimension. Therefore, the qualitative analysis of primary school curriculum does not identify a close correlation that integrates discipline-specific competencies into digital competence, but records the presence of some suggestions for learning activities involving the Internet, computer and other ICT tools and which we propose to evaluate quantitatively, referring to the total number of learning activities that the recommendations of the school curriculum sums up, in order to identify a symbolic value for the degree of their contribution in the development of digital competence.

In the following table there is a transposition of the qualitative analysis in quantitative terms, or in other words, the distribution of the learning activities identified and listed in the previous table, on a structure of disciplines and years of study,

⁶ UCE, Programele școlare care se aplică pentru învățământul primar începând cu anii 2013, 2014, <http://programe.ise.ro>

Discipline / Class	P.	1st grade	2nd grade	3rd grade	4th grade
Communication in Romanian	0	0	2	-	-
Romanian language and literature	-	-	-	3	1
Communication in the modern language 1	0	0	1	-	-
Modern language	-	-	-	1	1
Mathematics and environment exploration	3	0	0	-	-
Mathematics	-	-	-	0	2
Natural sciences	-	-	-	2	2
History	-	-	-	-	4
Geography	-	-	-	-	0
Civic education	-	-	-	0	0
Religion	0	0	0	0	0
Physical education	0	0	0	0	0
Game and movement	-	-	-	0	0
Music and movement	0	0	0	1	2
Visual arts and practical skills	0	0	0	0	2
Personal Development	0	1	0	-	-
Total	3	1	3	7	14

Table 2. Quantification of learning activities, within the school curriculum at the level of primary education, with significance for the development of digital competence

The total represented by 28 learning activities, relevant in the development of digital competence and listed in the qualitative analysis, were distributed on the study disciplines and the corresponding years of study, providing an overview of their presence in each stage of primary education.

A comparative analysis will be made by counting all the learning activities suggested by the school curricula at the level of primary education, then reported to the number of activities that have significance

in the development of digital competence. This counting and distribution of the total number of learning activities, by years of study and disciplines, is shown below:

Discipline / Class	P.	1st grade	2nd grade	3rd grade	4th grade
Communication in Romanian	128	153	153	-	-
Romanian language and literature	-	-	-	57	62
Communication in the modern language 1	31	32	31	-	-
Modern language	-	-	-	27	33
Mathematics and environmental exploration	116	172	187	-	-
Mathematics	-	-	-	111	111
Natural sciences	-	-	-	34	42
History	-	-	-	-	82
Geography	-	-	-	-	51
Civic education	-	-	-	29	32
Religion	37	40	46	48	39
Physical education	30	26	26	55	48
Game and movement	-	-	-	14	12
Music and movement	25	27	32	21	29
Visual arts and practical skills	53	56	41	50	36
Personal Development	46	54	52	-	-
Total	466	560	568	446	577

Table 3. Quantification of learning activities suggested by primary school curriculum in Romania

According to the MEN Order No. 3371/12 March 2013 on the approval of the framework plans for primary education and the Methodology on their application, the core curriculum comprises 16 study disciplines, the curricula of which inspire teachers with a number of 2617 learning activities and which, distributed by years of study and by disciplines, is shown in Table 3. In order to see the level of influence of

these learning activities on digital competence, we aim at relating these values to those with significance for the key competence whose descriptors have been identified through the qualitative analysis previously performed. At the same time, the ratio between the total number of activities and those with importance for the digital competence dimension shows whether there is or not a tendency in focusing the school educational process, from primary education, on the development of this key competence. The relationship between the two values of learning activities, overall or per year of study, as well as the proportion between them, are presented in the following table:

Years of study	P	1st	2nd	3rd	4th	Total
Learning activities	466	560	568	446	557	2617
Learning activities conducive to digital competence	3	1	3	7	14	28
Percentage ratio	0.643%	0.178%	0.528%	1.569%	2.513%	1.069%

Table 4. The value of examples for learning activities that contribute to the development of digital competence, out of the whole examples of learning activities cumulated in the school curricula related to primary education

Thus, the percentages from the table provide the degree of closeness of learning activities, offered as examples through school curricula at the level of primary education, to objectives aimed at in the process of developing digital competence. The reporting between these examples was made both per year of study and in total, for the entire primary education. Therefore, the comparative analysis in Table 4 totalizes a number of 2617 learning activities suggested by the school curricula for all subjects from the preparatory grade (P) to the fourth grade. In order to estimate the degree of belonging of specific competencies, thus developed, to digital competence, were counted only those learning activities, at the level of primary education, which were integrated in the development of specific competencies for determining their derivation from digital competence, totaling 28 such examples in a period of 5 years of schooling. This report reveals the degree to which the learning activities exemplified in the school curricula are participating in the development of digital competence and this degree expressed in percentages is 1,069%. Therefore, the participation rate of the suggested learning activities in the development of this key competence is a little over 1%, a value at which the influences determined by them are not so significant. The distribution of the same elements of comparison, by years

of study, leads to similar scores where the lowest degree of harmonization of learning activities with objectives of developing digital competence is obtained in first grade, 0.178%, and the highest degree is found in the fourth grade, 2,513%, this being the interval in which the observed values vary. At the same time, the percentages per years of study reveals the influence with which the analyzed learning activities nurture and train the digital competence at the level of primary education. However, in order to take place for the lack of integration of digital competences in primary education, optional subjects in the curricular field of technologies can be introduced, Primary Education Framework Plan having allocated one hour per week⁷ in this regard.

Quantitative analysis gives us an overview of the common contribution which the learning activities designed to achieve educational goals had on the disciplines of primary education, in the building of digital competence. These percentages are closer to the maximum values that these learning activities can take in the teaching activity, taking into account the fact that there are enough cases where the logistics infrastructure at primary education level does not have ICT tools to address the digital dimension in education. For this reason, the general values, at national level, may be even below the ones revealed by the quantitative analysis.

We obtained the graph of the comparative analysis which shows the maximum possible learning activities that can lead to the development and training of the key competencies through specific competencies, these values representing the total number of learning activities promoted through primary school curricula, as well as those values of learning activities that offer development perspectives for digital competence. The distribution of these elements of the analysis was made on the 5 years of study that comprise the primary education.

⁷ Ministerul Educației Naționale, *Planul cadru pentru învățământul primar, aprobat prin OMEN 3371/12.03.2013*, http://programe.ise.ro/Portals/1/Curriculum/PL_cadru-actuale/Primar/1_OMEN_3.371_12.03.2013%20privind%20aprobarea%20planurilor-cadru%20inv_primar%20si%20a%20Metodologiei%20privind%20aplicarea%20planurilor-cadru%20de%20invatamant.pdf

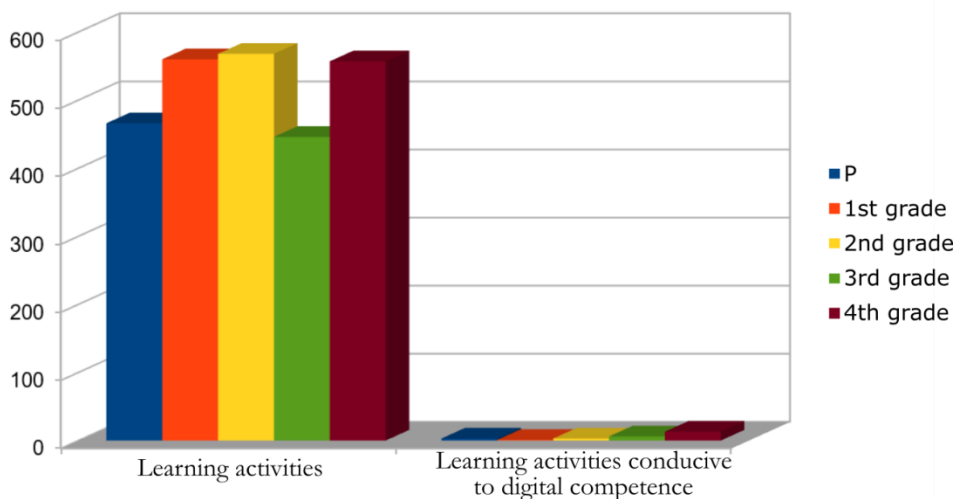


Figure 1. The distribution of activities conducive to the development of digital competence, in relation to the total number of examples of learning activities offered through school curricula at the level of primary education

An analysis, from a quantitative point of view, of the learning activities proposed through the current school curricula for primary education, shows that the opportunities that highlight and determine changes, in a positive sense, on the line of digital competence as an integral part of key competencies are insignificant. For the acquisitions of primary school students, in order to meet an elementary level of development on the dimension of digital competence, it is necessary for learning activities to include ICT tools and content in a higher percentage than the present findings.

In the given context, where digital education becomes an important element in the learning process, digital competence requires a special attention, especially since it has the ability to train and support the development of the other 7 key competences for lifelong learning.

Conclusions

The present offer for primary curriculum, as previously seen, participates to a small extent in the configuration of a profile of the primary education graduate, with an elementary level of development of digital competence. In this regard, the *Strategy on the digitalisation of education*

in Romania proposes necessary and welcome measures and actions, such as⁸:

- „the introduction in the primary education curriculum of some elements of compulsory and novelty character aiming the acquisition of digital competences, in accordance with the development profile specific to the level”;
- „introduction of digital security elements in the primary and secondary education curriculum, inclusively through the development of the national optional curriculum offer”;
- or „modules/ optional disciplines to stimulate creativity and innovation, as well as computational thinking, starting from primary education (eg robotics, 3D printing, RPA, IoT)”;

In the context of the imminent digitalisation of education in Romania, this analysis of curricular documents outlines the need of focusing on digital education starting with primary education, what is left behind by future curricular updates at this level of education as well as school prospects of tomorrow viewed through the *Strategy on the digitalisation of education in Romania* (document in public debate).

⁸ Ministerul Educației și Cercetării, *Strategia privind digitalizarea educației în România 2021-2027* (document în dezbateri publice), 2020. <https://www.edu.ro/sites/default/files/SMART.Edu%20-%20document%20consultare.pdf>.

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